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An Analysis of the EPA Chemical Use Classification System and the OTS Exposure Estimation Methodology

SRI International, Menlo Park, CA

Prepared for

Environmental Protection Agency, Washington, DC Office of Toxic Substances

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Contractor's Report

An Analysis of the EPA Chemical Use Classification System and the OTS Exposure Estimation Methodology

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16. ABSTRACT This report contains separate evaluations of the EPA Chemical Use Classification System and the OTS Exposure Estimation Methodology developed by EPA/OTS and another contractor. The Use Classification System describes uses of chemicals in terms of two components, function and application. The results of a three-part study of the systems led to the conclusion that the system provides neither adequate application terms nor satisfactory instructions to assure that the available terms will be used in essentially the same way by the various users. The Exposure Estimation Methodology was analyzed by statistical and systems analysis methods and found to be seriously lacking. The overall scores produced by this scoring system are probably not usefully related to exposures which would occur due to a particular chemical use.		
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Evaluation	Methodology	14/07
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Foreword

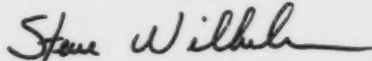
The EPA Chemical Use Classification System (CUCS) has been under development in the Office of Toxic Substances (OTS) for approximately a year and a half. This complex and difficult task has been through several phases, and through this effort OTS has learned a great deal about how chemicals are used and how they flow through the market. Development of CUCS will continue for several more months before it is proposed for use under TSCA reporting rules.

This report includes an independent evaluation of CUCS by Stanford Research Institute (SRI), an EPA contractor. SRI received the system from the Technical Monitor in early May 1979, and completed the evaluation in late June 1979. During this two-month period, conversations and review sessions with this contractor revealed several problems that are detailed in this final report. OTS has been actively working on CUCS development since receiving it from another contractor in mid-April 1979, and had independently identified many of the problems noted by SRI.

The most significant problems relate to the instructions for using the system and the list of applications. SRI identified several inadequacies in the instructions. Unfortunately, some ambiguities in the instructions led SRI to make assumptions which affected much of the rest of their analysis -- assumptions that were not representative of actual OTS intentions for CUCS. The SRI analysis, in combination with an ongoing analysis by OTS, proved very beneficial in completely revising these instructions. The other major area of concern for SRI was the list of applications. OTS has plans for extensive revision of the applications list both in response to SRI's criticisms and as a result of other concerns identified by OTS. Thus, many of the problems that SRI identified have been or will be resolved as OTS completes development of CUCS.

In summary, CUCS is under continuing development. This report analyzes the system at about the halfway point in its development and should be read in that light. OTS believes that this report has been a useful contribution in the development of CUCS.

Steven L. Wilhelm, (Technical Monitor)



Chemist, Program Integration Division
August 20, 1979

EPA 560/13-79-007

AN ANALYSIS OF THE EPA CHEMICAL USE
CLASSIFICATION SYSTEM AND THE OTS
EXPOSURE ESTIMATION METHODOLOGY

June 1979

Contract No. 68-01-4109

Research Request No. 4

Project Officer: James Darr

Technical Monitor: Steve Wilhelm

Prepared for:

Office of Toxic Substances
U.S. Environmental Protection Agency
Washington, D.C. 20460

NOTICE

This report has been reviewed by the Office of Toxic Substances, EPA, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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PREFACE

This report was prepared by an interdisciplinary team under the general guidance of the Project Officer, James Darr, the initial EPA Technical Monitor, Henry Lau, and the EPA Technical Monitor during most of the work, Steve Wilhelm. The SRI International team consisted of Jeffrey Allport, Sharon Casey, Janet Hardy, Buford Holt (Task Leader), and Kirtland McCaleb (Project Leader). Assistance was also provided in certain areas by Stephen Brown, Eleanor Connolly, David Cox, Mary Doeltz, Douglas Fowler, Richard Gerry, Alexi Miller, Benjamin Suta, Laurie Swett, and John Toevs.

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I INTRODUCTION

Background

As part of its responsibilities under the Toxic Substances Control Act (TSCA), the Environmental Protection Agency (EPA) may ask manufacturers, importers, and processors of commercial chemicals to report on the uses of these chemicals. In anticipation that such use information will be sought and that it will need to be collected and stored in a logical manner, EPA's Office of Toxic Substances (OTS) contracted with Auerbach Associates, Inc. (now known as Calculon) to prepare a Use Classification System. The system developed by Calculon in 1977 identifies the use of a particular chemical by combining a unique function with a unique application. It was used to produce a Chemical Use List, containing approximately 800 function/application combinations, which was published with a request for public comment, in the Federal Register on July 25, 1978.

During the development of the Chemical Use List, the EPA also asked Calculon to develop an exposure estimation methodology based on its Use Classification System, in which chemical use categories are used as surrogates for exposure data on individual chemicals. The methodology developed by Calculon and subsequently modified by OTS considers aspects of occupational, consumer, and environmental exposure to chemicals and provides an Exposure Estimation Methodology in which scores are assigned to the individual components so that an overall score can be obtained for each chemical.

A combination of concerns expressed by EPA staff members and the public comments received in response to the Federal Register request led EPA's Office of Toxic Substances to seek a third party evaluation of both the Use Classification System and the Exposure Estimation Methodology. SRI International (SRI) was asked to do these evaluations

in Research Request No. 4 under Contract No. 68-01-4109; the results of this work are described in this report.

As originally presented to SRI, the task to be carried out under Research Request No. 4 consisted of four subtasks. The first of these was to be an evaluation of the Chemical Use List as described in the Federal Register. The other three subtasks called for: (1) an evaluation of the Exposure Estimation Methodology (including the development of an alternative methodology, if appropriate), (2) scoring of the uses in the Chemical Use List by the methodology, and (3) using the scores to rank the uses into a limited number of groups.

At the outset of the work on this Research Request, the Chemical Use List was being revised by Calculon to incorporate some changes suggested in the Federal Register responses. Consequently, the EPA Project Monitor directed SRI to delay working on the Chemical Use List until the revised version became available and to proceed with the subtasks involving an evaluation of the Exposure Estimation Methodology.

One major change made by Calculon as a result of the public comments was to abandon the combination of specific functions with specific applications. This meant that the approximately 800 uses characterized by the combinations were eliminated (replaced by an unknown number because any function could now, at least theoretically, be combined with any application). The impact of this change on the subtasks of this Research Request was that two of the subtasks--using the methodology to score uses and then ranking the uses into groups--were deemed inappropriate by the EPA Technical Monitor. The work on this Research Request was therefore concentrated on Task 1, the evaluation of the Use Classification System, and Task 2, the evaluation of the Exposure Estimation Methodology.

Objective

The objectives of the two studies reported in this document were as follows:

- Evaluation of the Use Classification System

To provide a sound and carefully reasoned independent assessment of the virtues and failings of this system. Consideration of the public comments on the system and the difficulties encountered in carrying out selected trial runs on the system were to be used in the evaluation but were not to be the sole basis on which conclusions and recommendations are based.

- Evaluation of the Exposure Estimation Methodology

To evaluate the reasonableness and technical correctness of this methodology, suggest modifications designed to improve it, and characterize the utility of the resulting methodology for estimating human exposure to new chemicals, to old chemicals in new uses, and to old chemicals in old uses.

II SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The work carried out under Research Request No. 4 consisted of the following two separate studies:

- Task 1

An evaluation of the merits of the EPA Chemical Use Classification System, which had resulted from revising the Chemical Use List published in the Federal Register of July 25, 1978.

- Task 2

An evaluation of the merits of the OTS Exposure Estimation Methodology, which had resulted from modifying the original exposure estimation methodology developed by Calculon.

Task 1 (described in detail in Chapter III) was carried out in three subtasks. The first of these was a review of the comments on the Chemical Use List received from industry in response to the request for public comments on July 25, 1978. The second was a trial run of the Use Classification System on five selected chemicals and four selected product types. The last subtask was an overall evaluation of the five components of the system.

Task 2 (described in detail in Chapter IV) consisted of a review of the OTS Exposure Estimation Methodology, the development of a modified methodology to eliminate the major problems uncovered in this review, and an assessment of the likely results of applying the modified methodology. For application to new chemicals or new uses of old chemicals, the assessment included consideration of the probability that the components of the exposure estimate could be accurately determined, the significance of scoring errors in making decisions based on the scores, and the accuracy of the methodology. Similar considerations were also taken into account in evaluating the utility of the methodology for application to old chemicals in old uses.

Task 1

The principal findings of the three subtasks are described in the following summaries.

Subtask A. Review of Industry Comments

The chief general concerns centered on what the system would be used for, its confusing nature, and the apparent necessity for producers rather than end users to identify uses. Suggestions for improvements ranged from better instructions and definitions to adoption of SIC Codes and reorganization of the format. Alternative approaches stressed systems that focused on chemicals and exposure situations to provide more useful information.

Subtask B. Trial Run on Selected Chemicals and Product Types

These exercises in using the system uncovered problems in the instructions (particularly the examples cited for illustration) as well as missing entries in the Indices, missing terms in the functions and applications lists, and confusing groupings of terms (particularly in the applications list). Numerous instances arose where the most appropriate terms for classifying a use could not be determined or the only function or application term available was not sufficiently specific to characterize the use to the degree of detail that the information available on the chemical or product permitted.

Subtask C. Overall Evaluation of the Use Classification System

This subtask disclosed likely future problems when new uses are added (resulting from the use of both consecutive code numbers and alphabetical listings and from the procedures for reporting new functions and applications). In addition, the necessity for a hierarchy in the functions list was brought into question. A need for more entries and cross references in both the functions Index and the applications Index became evident. Several problems related to the hierarchy of the

applications list, the variability of the use of the hierarchy to subdivide major application categories, and additional instances of application terms that lack specificity were found during the subtask.

Task 2

The principal finding of the evaluation of the OTS Exposure Estimation Methodology was that the chances for its success in estimating human exposure to chemicals (without having exposure data on individual chemicals) would be greatly increased if the scales and the relationships of the component measures of exposure were more consistent. A modified methodology involving eight parameters was subsequently developed and its ability to provide accurate results was evaluated by a panel of SRI staff members. This evaluation indicated that the probability of correctly assessing all eight parameters was only about 0.006. In addition, it was estimated that the probability was more than 0.9 that data provided by manufacturers, importers, and processors would provide more accurate scores on specific chemicals.

Taking into consideration that the scores would only be used to decide which chemicals should be included in the group chosen for further study, it was illustrated that the errors in scoring probably only had a slight effect on the accuracy of the decision. However, the probability that the score assigned to a use category would be a reliable indicator of the exposures associated with individual chemicals within the category was estimated to be quite low. Even with an optimistic estimate for this probability, the overall probability that the exposure estimate for a given new chemical or new use of an old chemical would be correct was only 0.06, or one in sixteen.

When the methodology was applied to old chemicals in old uses, the inaccuracies of the methodology did not eliminate its utility. The evidence indicated that the methodology could probably be used to select the upper tail (e.g., the top 10%) of a large group with scores showing a normal or log normal distribution without missing many high exposure chemicals. Using the scores for selected components of the scoring

methodology as a basis for screening out chemicals on a systematic basis was also investigated as a way to reduce the cost of applying the methodology to a large number of chemicals.

Conclusions

Task 1

The chosen method for describing a particular use of a chemical as a combination of a function and an application is a logical approach to distinguishing between different uses and, in fact, is the core of the typical textual descriptions of uses. Such narrative descriptions frequently become long and involved, however, in an effort to define the use adequately and differentiate it from similar uses. When one attempts to simplify these descriptions and present them in an abbreviated form such as that used in the Use Classification System, the problem is one of retaining in the description those aspects of the use that illustrate its uniqueness. Consequently, the terms must have very precise meanings not subject to a variety of interpretations.

In spite of some problem areas (e.g., an unneeded hierarchy and terms that describe more than one function), the Use Classification System appears to have done quite well in achieving both brevity and accuracy in its treatment of the functions of chemicals and in instructing the user of the system about the selection of the appropriate function term. Unfortunately, in the section on the applications for chemicals, the system provides neither adequate terms to specify unique applications nor satisfactory instructions to assure that the available terms will be used in essentially the same way by the various users of the system.

Task 2

Even with the modified methodology represented in Table 2 and with a relatively high probability that individual chemicals will be correctly assigned to use categories and that correct exposure estimates will be assigned to the use categories, the utility of the methodology is marginal. This occurs because of the low probability that the exposure estimates for use categories will accurately reflect the

exposures associated with individual chemicals. If the methodology is used as the basis for deciding which new chemicals or new uses of old chemicals should be studied further, we believe that the probabilities of erroneous decisions will be quite high. Consequently, although the use categories and associated exposure scores may have some utility for use by the EPA staff in evaluating the reasonableness of assessments of exposure made by industry, they do not provide a satisfactory surrogate for such data. In fact, far more accurate assessments of exposures could likely be obtained by analysis of the data submitted with premanufacture notices than could be obtained with the exposure estimation methodology.

For old chemicals in old uses, the situation is not much more encouraging. It appears that the methodology could be useful to identify the old chemicals with the highest exposures but not consistently useful for discriminating among these high ranking chemicals. However, the cost of using the methodology on a large number of chemicals even if done in a stepwise manner using selected components of the scoring methodology, might be prohibitive considering the quality of the information likely to be obtained.

Recommendations

It appears that the initial interest of the Office of Toxic Substances in a system for classifying the uses of chemicals stemmed from a need for a method by which manufacturers, importers, and processors could report on the uses of chemicals. The use information could then be used to estimate exposure to chemicals. Assuming the need still exists, then the OTS might better approach the problem by suspending further effort on the current Use Classification System until the method by which exposure estimates will be made is clarified. Once this is done, it might well prove more cost effective to construct an alternative system focused on individual chemicals, selected product groups, or exposure situations than to attempt to use even an improved version of the current classification system in the new context.

For any other purposes to which a Use Classification System is to be put, we recommend that all of these purposes be carefully developed and analyzed to determine exactly what is needed from the classification system before proceeding with the current system. If uses are to be identified in very specific terms, then considerable work is needed on the current system to achieve this goal. If the relationship of new uses to the functions and applications in the current system are of importance, then a procedure to permit users to add new functions and applications in the appropriate places throughout the whole hierarchy of the lists (rather than just to special "Other" and "Miscellaneous" categories) will be needed.

In the belief that the EPA plans to put the Use Classification System and the data received from industry into a computerized data base, we recommend that the EPA reconsider how code numbers are used in the system. The present combination of consecutive code numbers and alphabetical listings will require extensive revisions each time new uses are added to the system. The following three alternatives are suggested for consideration (others might result from additional analysis beyond the scope of this task): (a) use a non-consecutive numbering system so that new numbers could be inserted for new functions and applications; (b) use a numbering system that is independent of the alphabetic sort sequence; and (3) drop the numbering system.

Based on the results of the evaluation of the OTS Exposure Estimation Methodology, we recommend that this methodology be replaced by a combination of case-by-case analysis of data submitted on individual chemicals and a more flexible system for estimating exposure to the chemicals in the use categories based on narrative characterizations of these use categories. Such narrative accounts would provide a richer, more useful set of observations on which to base decisions. They could include details on the manner in which chemicals within the use categories are handled, the environments within which they are used, the variations in the known properties of the chemicals within these categories (and, consequently, the variations in the physical forms in which the chemicals are used), the route of exposure (dermal, oral, etc.), and the duration of exposure.

III EVALUATION OF THE USE CLASSIFICATION SYSTEM

In Task 1, SRI International assessed the merits of the revised Use Classification System supplied by the EPA Technical Monitor in May 1979. This assessment is based on the results of a study consisting of the following three subtasks, which are described in greater detail below:

- A review of the industry comments on the original Chemical Use List published in the Federal Register of July 25, 1978. (Public comments have not yet been sought on the revised Use Classification System.)
- A trial run using the Use Classification System to classify the uses of five selected chemicals and to check the accuracy and completeness of the system against the known functions and applications of the component chemicals in four selected types of products.
- An overall evaluation of the system with respect to its format, content, and utility.

Subtask A: Review of Industry Comments

The Use Classification System developed by Calculon was published in the Federal Register for July 25, 1978. Public comment was solicited on the issues and problems identified below, or on any other issues related to the list, including alternative approaches to chemical use classification.

- Are there uses of chemicals not covered in Appendix I? If so, what are these uses? Please describe them, if possible, in terms of a "function" and an "application," and provide a suitable brief statement describing each such use.
- Are the uses in Appendix I clearly understandable? How can the definitions of the function terms be improved?
- Are any uses cited in Appendix I so ambiguous that a given use might fall into more than one function/application combination? How can any such ambiguity be resolved?

- To what extent, if any, should the Chemical Use List be changed by modifying, aggregating, or expanding the existing uses?
- Can this list be used by persons with only a moderate technical background to easily and accurately determine how to classify a chemical use?

The responses received from industry were assigned response numbers by EPA and forwarded by the initial EPA Technical Monitor so that these responses could be analyzed as part of the assessment of the Use Classification System. This section of the final task report describes the results of this analysis.

In the following synopsis of the industry comments, only those comments related to an evaluation of the system were reviewed because Calculon has already addressed the 69 comments covering changes in the listed functions and applications, and the EPA is considering a complete formal review of the revised list at a later date.

General Comments

Prior to discussion of specific suggestions for improvement or for alternative schemes, those industrial comments of a more general nature related to the proposed classification scheme are enumerated. The numbers appearing in parentheses in the following text are the numbers assigned to this type of industrial comment in Appendix A, where the respondents submitting comments of this type are identified by the response number assigned to them by EPA.

- Fifteen respondents prefaced their comments by noting the difficulty of evaluating a proposed classification scheme without knowledge of its scope, purpose, and intended uses (1).
- Five respondents concluded that the use list is usable and understandable (2).
- Only one respondent suggested abandoning the whole scheme outright (3), although ten questioned the usefulness of such a classification system to the EPA because function and application yield no exposure information and are irrelevant from a risk evaluation standpoint (4).
- Six replies emphasized the burdens of reporting uses and of updating and maintaining such a classification system (5).

- Eighteen of the responses included comments that end-users, not primary manufacturers, should define use. Applications of a chemical are frequently unknown to a manufacturer, and, in situations where applications are known, confidential market information, trade secret arrangements, etc. would be violated by disclosure (6).
- Twenty-one respondents judged the system to be too confusing for persons of moderate technical background to comprehend (7).
- Among the difficulties of use, the ambiguity of the terms "functions" and "applications" was the one most often mentioned (8). The chief concern was that some people will interpret the terms differently and assign different use designations for the same chemical where, in fact, the uses are the same. This situation would be aggravated by the fact that the nomenclature used by the EPA is not necessarily that used by industry, and also by variations in nomenclature from one industry to another.
- Separating the lists of functions and applications (a modification subsequently accomplished by Calculon) was suggested by seven respondents as a step to reduce ambiguity (9). Another possible solution (recommended in seven responses) to the ambiguity problem was the suggestion that the reporting of chemical uses be done in the industry's own words rather than in the EPA's function-application terms (10).
- Nine respondents mentioned the relationship of the proposed classification scheme to Significant New Use Rules (SNURs). Most commented on the prematurity of developing a chemical use list without first defining significant new use and developing SNURs in parallel with development of a use classification system. Some respondents pointed out that criteria for significant new uses involve exposure considerations beyond the scope of a chemical use list (11).

Specific Suggestions for Changes

Twenty-four responses offered specific suggestions for changes to improve the proposed classification system. An abbreviated list of these suggestions follows.

- Simplify the instructions to enable a person of moderate technical background to use the system easily and accurately (12).
- Define function and application more clearly to avoid misinterpretation and incorrect assignment of chemicals to categories (13).

- Broaden and generalize categories of use to bring them more in line with present industrial practices (14).
- Include an "unknown" category for those chemicals for which the manufacturer does not know the final application (15).
- Include a "starting material" category to describe a chemical raw material that is used in a chemical reaction to subsequently form a product (16).
- Use an alphabetical rather than a numerical system so that new entries may be made easily and flexibly (17).
- Do not use alphabetical arrangements (in direct opposition to the preceding suggestion). Rather, use a three- or four-level hierarchy with similar functions and applications grouped together (use alphabetical order only when there is no other basis for ordering) (18).
- Base applications on all 99 major groups listed in the SIC Manual rather than on only 39 groups (19).
- Correlate both functions and applications with SIC codes to increase the usefulness of this scheme to OSHA. (Compliance officers need to know what chemical substances are likely to be associated with a particular type of industrial process) (20).
- Reverse format to make functions subheadings of applications (21).
- Reorganize the function/application use term combinations in Appendix I into major classes in order to make list more useful (22).
- Expand the codes and eliminate aggregated function and application codes to counteract ambiguity and better serve more precise classification (23).
- Use less detail in the applications listing to avoid superfluous categorization of unimportant differentiations (24).
- Redesign the use list to be more comprehensive with regard to the industries affected and not a model designed merely for the chemical industry. This would reduce the confusion resulting from nomenclature variations of function/application combinations in different industries (25).

Suggestions for Using Different Sources

Two respondents recommended that different sources be used for development and refinement of a use list reflective of today's technology (26).

- Develop a list from EPA-funded computer searches of Chemical Abstracts, which would include large-scale uses as well as the many specialized uses disclosed in patents.
- Use U.S. Patent and Trademark Office information, which would be a good source of functions and applications of new chemical compounds. It was noted that there is, in addition, an International Classification System used for classifying patents, which might provide additional pertinent information.

Suggestions of Alternative Approaches

Six replies included alternative approaches to the proposed classification scheme, which would, in the opinion of these respondents, be better adapted to the regulatory objective of making risk assessments (27). A brief description of the suggested schemes follows.

- Make listing by chemical, not by function. (Typical rule-making targets a chemical or category of chemicals; therefore, a chemical-based list makes more sense for EPA than a use-based list).
- Simplify the function component; relate it to the presence of a chemical in a process or product, which is more important to its possible regulation than is indication of its actual function. Therefore, functions can be reduced to raw material, intermediate, by-product, etc.
- Compile exposure-related information directly by chemical rather than to infer it from functions and applications. Exposure data are quantifiable by individual respondents and would lend themselves to further summation.
- Reorient the use list to emphasize information on chemical exposure. Such a list, more properly entitled "Chemical Exposure List," could be developed in three sections:
 - Type of exposure (i.e., industrial, commercial, household, personal)
 - Frequency of exposure (i.e., intermittent, continuous, confined environment, dispersed environment)
 - Extent of exposure (i.e., number of people exposed, environmental exposure)

The above information could be analyzed in some type of ranking system that would focus on uses that result in significant exposures.

- Modify the use list to focus directly on exposure. Specifically, delete the function list as it is not a satisfactory indicator of exposure, eliminate subdivisions for functions and applications because they convey no unique meaning for exposure, and use application terms having significance for exposure.

Subtask B: Trial Run on Selected Chemicals and Product Types

As a method of sampling the number and types of problems that industrial users might encounter in using the Use Classification System, a trial run was carried out. In this trial run the system was used to classify the known uses (as identified in existing SRI data bases) for the following five commercially significant chemicals: ammonia, ethyl acetate, ethylene, urea, and sulfuric acid. In addition, the system was checked for accuracy and completeness against the known functions and applications of the component chemicals of the following product types: industrial adhesives, household detergents, rubber processing chemicals, and trade sales paints. The results obtained from this trial run are described in this section.

Classification of Uses of Five Selected Chemicals

The description of the uses of ammonia, ethyl acetate, ethylene, urea, and sulfuric acid in industry terms and the Use Classification System function and application terms to which these uses were assigned are summarized in Appendix B.

Problems Encountered During Trial Run on Selected Chemicals

Format--No particular problems attributable to the format of the Use Classification System were encountered.

Content--The nomenclature used by industry is not necessarily the same as that used by the Use Classification System. For example, the term "ripening agent" for fruits and vegetables is commonly used in industry to define a function of ethylene. The listing of functions does not include "ripening agent" nor does it include a cross reference

to this term. Therefore, "growth regulator" had to be selected from the function listing as the most appropriate descriptor, although it is not the term of common industrial usage.

The listing of application terms was found in many instances to be lacking in specificity. Of the many examples of this problem encountered in classifying the uses of the five selected chemicals, a limited number are given below:

- Although coal mining is included in the listing of applications, no entries are related to activities beyond the mine site. Consequently, no terms are available for applications in the refining of coke oven products.
- No polymer listing appears in the application index. In the classification of uses of ethylene in which the function assigned was "monomer," to a reporter unfamiliar with plastic and synthetic materials, the term "polymer" would follow as the logical application descriptor. An Index listing of "polymer" with a cross reference to "plastic and rubber materials and synthetics (not fabricated)" would clarify the classification.
- No chemical mixture entry appears in the application listing so chemicals used to make products that are chemical mixtures cannot be assigned an adequate application. Specific situations in which a chemical mixture designation could have been applied in this trial run were in such industrial uses of sulfuric acid as its use in coke oven light oil refining and tall oil recovery.
- No entry exists in the application list for shellacs. The term "bleached shellacs" does appear under related paint products, but this term describes only a subset of shellacs and should not be used to classify shellacs as a whole. The particular problem of classifying shellacs is further discussed in the trial run on Trade Sales Paints which is described below.
- No subcategory exists under the heading "Metal processing operations" to specify the nitriding of ferrous alloys. This common industrial practice, which produces surface hardening, involves the heating of the alloy in the presence of ammonia or other nitrogenous material. None of the given application terms specifically describe such a use in meaningful terms.

- Although burial services is included in the listing of application descriptors, there are no specific entries for such burial-related uses as embalming fluids. One use of ethyl acetate is as a component of such fluids. Because the available application term, burial services, seemed too generalized to describe embalming fluids appropriately, this application term had to be assigned to "Miscellaneous Products and Services."

The definitions given for function descriptors in some cases lack precision and completeness. This problem was encountered in the classification of the use of both ammonia and sulfuric acid in phosphate rock flotation. The Use Classification System definition of flotation agent describes only the function of a collector. Although this is a key function of flotation agents, the term is generally used to cover such other functions as depressants and frothers. Therefore, the function, "flotation agent," was assigned to the sulfuric acid use with some reservations. "Chemical raw material" was selected for the ammonia use because the "flotation agent" definition was not broad enough to include modifying agent as a function.

In some cases, the application listings are difficult to define without reference to the SIC Code on which the listing appears to be based. For example, to determine that parchment paper (the processing of which involves sulfuric acid) should be assigned to the application "Packaging and industrial converting paper," it was necessary to refer to the SIC Classification. Because the Use Classification System listings and the SIC listings are not in the same order, comparison of the two for purposes of application identification can be a problem.

Utility--The instructions for the Use Classification System include directions for the addition of new application terms when no appropriate term is found in the existing list. Such an addition is to be reported under "Miscellaneous Products and Services." This leads to misplacement of terms, which in most cases properly belong in an already existing application category. For example, the addition of a term to describe the nitriding of ferrous alloys should be added under

the heading of "Metal Processing Operations" and not under "Miscellaneous Products and Services."

The trial run was characterized by several examples of a problem relating to the basic question of how far a manufacturer of industrial chemicals can or should go in identifying and classifying uses of these chemicals. If a chemical is used to make another chemical, apparently the classifying stops there. However, if a polymer results, the sample on page one of the instructions seems to indicate that classification should be based on the end-use application (or, more likely, applications) of that polymer.

Conclusions from the Trial Run on Selected Chemicals

Format--The alphabetical index listing accompanied by organization of terms into a hierarchy ranging from general to specific made the classification of uses of the five chemicals logical and straightforward.

Content--Several modifications of the content of the classification system are suggested:

- The nomenclature should be made to be consistent with that of industry.
- Another level of hierarchy under certain function terms should be added to increase the degree of specificity, precision, and completeness of the classification of an industrial chemical.
- Addition of either new levels of hierarchy or new terms under existing levels should be undertaken to improve the specificity of application descriptors. If such a Use Classification System is to prove valuable to the EPA as a basis for making risk assessments, specificity is of the utmost importance.
- Additional cross references in the Index of applications would simplify use of the system by persons unfamiliar with the terminology of the industry in question.

- A more direct correlation of applications with the SIC Code should be attempted to simplify assignment of an accurate application descriptor to a chemical use. Perhaps listing as subsets under an application heading all products and services which appear in the SIC Code under that same heading should be considered. This would encourage uniformity of reporting between industries.

Utility--Instructions should include directions for adding new terms to all levels of the hierarchy of existing application categories. Instructions should include an example of a chemical, to replace the acrylonitrile example, for which the function and application assignments are straightforward.

Classification of Functions and Applications of Chemicals in Selected Product Types

In this portion of the trial run, information was gathered on the functions of the component chemicals in four product types (industrial adhesives, household detergents, rubber processing chemicals, and trade sales paints) and on the applications for the different products within these product types. The resulting information, described in terms normally used in the industry, was then converted into the function/application terms used in the Use Classification System to check the system for accuracy and completeness and to note the number and types of difficulties experienced in making the conversions.

Product Type: Industrial Adhesives

The following five terms were found to be the ones in most common use within the industry for describing the functions of the component chemicals in industrial adhesives:

- Filler (Extender)
- Plasticizer
- Solvent
- Tackifier
- Thickener.

The applications in which these functions are performed as described in industry terms and the trial run assignments to Use Classification System function and application terms are summarized in Appendix C, pages C-3 to C-39.

The problems encountered and conclusions reached from this part of the trial run are described in this section.

Format--No problems were encountered that were specifically due to the format of the Use Classification System although some changes in format are suggested below which relate to problems of content and utility.

Content--The definitions of function terms seem to differ between the adhesives industry and the Use Classification System. For example, the industry tends to group extenders and fillers together whereas the Use Classification System provides separate definitions. Because both of these definitions could be considered applicable to the function of such chemicals in adhesives, the manufacturer, accustomed to using industry terminology, may select one or the other without considering the fine distinctions made by the Use Classification System.

Adhesives are used for attaching filters to cigarettes; however, in the Use Classification System, "Tobacco production" is the only application term related to tobacco applications. Because this term refers only to the agricultural production of tobacco and not to the production of tobacco products, no satisfactory application term exists for describing the operation of cigarette tipping.

Carpet laying, as an activity, also employs the use of certain adhesives but no application term was found to classify this operation. The closest possible term appeared to be "Floor laying, scraping and finishing," but this term is a subset of "Carpentry and floor laying," which implies the construction of wood floors. Thus, carpet laying is without an adequate applications descriptor.

Even though the user is seeking the most specific term for a particular application, Use Classification System terms often must be selected that encompass a wide range of applications. For example, the application term, "Pressure sensitive tapes," is listed as a subset of "Paper and coated paper products." Consequently, those pressure sensitive tapes that are not based on paper--vinyl tape (for electrical purposes), cloth tape (for surgical use), and foil tape--had to be assigned application terms other than "Pressure sensitive tape." When this was done, only nonspecific terms were available, e.g., "Unsupported plastic film, sheet, rod and tube" appeared to describe vinyl electrical tape best but it also includes many other plastics applications. Similar problems resulted with surgical tape, best described by "Medical and dental instruments and supplies," and foil tape, best described by "Metal foil and leaf."

Occasionally, adhesive products are used by a particular industry in operations that use products of other industries and these situations create classification problems. For example, the food industry uses adhesives to seal cartons produced by the packaging industry and to apply labels obtained from label manufacturers to bottles and cans that are made by bottle and can manufacturers. These situations proved difficult to handle in a consistent and logical manner in the trial run. The use of adhesives in carton sealing was assigned to "Paperboard containers and boxes," even though the actual sealing is done by food and other packaged goods industries. This assignment was made because of the prospect that an extremely long list of applications would be associated with carton sealing if every industry using cartons for packaging was listed. In the case of bottle labeling, the products of the user industries doing the actual labeling were selected in the trial run even though the terms available--"Food and kindred products," "Drugs and other pharmaceuticals," and "Cosmetics and toilet preparations"--include numerous products that do not require bottle labeling. Similarly, can labeling was assigned to "Food and kindred products" even though subsets of this product category include cereal breakfast

foods and other noncanned products. Thus, the assignment of applications can result in an extensive list of specific terms or a short list of general terms, which includes application subsets not originally intended.

Another problem related to the level of detail implied by generic application terms is illustrated in the use of adhesives in furniture. Dowel gluing, for example, is an operation applied to wood furniture. Wood furniture applications are described in the Use Classification System by seven separate terms. Inclusion of all of these applications to cover dowel gluing operations did not seem appropriate. Therefore, in the trial run, furniture adhesives were classified under the general application term, "Household furniture," because it describes most wood furniture, and also under "Wood partitions and fixtures," because it includes plastic-laminated wood fixture tops. Unfortunately, the use of the application term, "Household furniture," implies inclusion of unintended subsets such as "Mattresses and bed-springs."

Utility--In some cases, an application can be defined by more than one of the application terms listed in the Use Classification System. Mobile homes, for example, could be classified either under "Miscellaneous transportation equipment" which includes recreational vehicles, or under "Prefabricated wood buildings." The listing for the latter indicates that the Use Classification System intends for mobile homes to be included under it. The user cannot find this out readily, however, because mobile homes are not listed in the applications Index; consequently, he may select "Miscellaneous transportation equipment." Thus, if an important term is not in the Index, a user of the system may not search through the Index enough to find the most appropriate term and, as a result, may use a term other than the one desired.

Summary of Conclusions from the Trial Run on Industrial

Adhesives--The following conclusions are evident from the trial run on industrial adhesives:

- Format

The extent of coverage intended for several of the general terms used in the applications list is explained in parentheses after the applications term. For example, the term, "Public building furniture and related furniture," has a three-digit code number and is explained as including "furniture for schools, theaters, restaurants, religious buildings, and libraries, as well as seats for public conveyances and automobiles." No four-digit code applications are listed as subsets of this application, however. To keep the user from having to select a term that implies usage in automobile seats when only theater furniture is intended, it is recommended that the individual specific applications mentioned in parentheses be assigned four-digit codes and be listed as subsets of "Public building furniture and related furniture." This greater specificity in the application terms would achieve greater clarity in the resulting data than possible with the present parenthetical explanations.

- Content

Appropriate application terms for the operations of cigarette production and carpet laying should be added to the applications list.

When an effort was made to select appropriate application terms for a given use, the definition of the preferred term sometimes prevented its use because that definition was too restrictive. Thus, "Pressure sensitive tape" is defined in the Use Classification System as a paper product, which prohibits using the term to classify usages in other types of pressure sensitive tapes, such as cloth surgical tape. Consequently, a term such as "Medical and dental instruments and supplies" had to be chosen for this application. However, it can then be improperly concluded that adhesives perform a function in the whole range of medical and dental instruments. Mistakenly associating a function with products that never use the function is a potential problem when a general application term is used because a more appropriate term is defined too restrictively.

Because differences in function terminology between industry and the Use Classification System exist, it is recommended that consideration be given to changing the instructions to allow the use of two function terms when

the industry makes little or no distinction between two similar terms. For example, because industry generally considers extenders and fillers as providing the same basic function in a product, the opportunity to use both terms would avoid having the same use reported one way by one reporter and the other way by another reporter.

- Utility

It is recommended that the instructions suggest that users of the System have on hand a 1977 Census of Manufactures, Numerical List of Manufactured Products, which explains in greater detail many of the categories in the application list. This publication breaks down manufactured products according to the hierarchy of the SIC Code System. Because the Use Classification System is based on the SIC system, the Census publication can help by providing the SIC origin of the application descriptor terms, by showing the intended scope of the various application descriptors, and what changes and combinations of SIC categories have been made in compiling the application descriptions.

"Mobile homes" should be made an entry in the Index with a cross reference to "Prefabricated wood buildings" where they are included in the parenthetical explanation. Perhaps an overall expansion of the cross referencing of the index should be undertaken to cover as many problems of this type as can be identified.

Product Type: Household Detergents

The following 16 terms were found to be the ones in most common use within the industry for describing the functions of the component chemicals in household detergents:

- | | |
|---------------------------|---|
| • Antiredeposition agents | • Fabric softeners |
| • Antistatic agents | • Fillers and diluents |
| • Bleaching agents | • Foam regulators |
| • Buffers | • Opacifying agents |
| • Builders | • Optical brighteners and bluing agents |
| • Colorants | • Perfumes |
| • Corrosion inhibitors | • Solubilizers |
| • Enzymes | • Surfactants. |

The applications in which these functions are performed as described in industry terms and the trial run assignments to Use

Classification System function and application terms are summarized in Appendix C, pages C-40 to C-45.

The problems encountered and the conclusions reached from this part of the trial run are described in this section.

Format--Only minor difficulties were experienced with the format of the list of functions and its index (e.g., no Index entry for "Perfumes" giving a cross-reference to "Fragrances"; the unusual Index entry for "Bleaches" referring the user to see two other functions also, "Bluing Agents" and "Optical Brighteners," which are seldom considered as bleaches because their action is one of masking, not removing, colors; and the reference in the Index under "Suds Control Agents" to "Foam Inhibitors" but not to "Foam Stabilizers").

The format of the applications list caused problems because of the unusual arrangement of the hierarchy and the selection of descriptors used for the applications. Although the list appears to be generally based on the SIC codes, the hierarchy, groupings, and terms have been changed significantly and the purpose of the changes is not apparent.

The SIC major category, "Soaps, Cleansers and Toilet Goods," has been replaced by "Sanitizing Agents, Polishes and Cosmetics," even though the applications covered are essentially the same as those covered by the SIC term. This change has eliminated one of the main components of the category, "Soap and Other Detergents," from any specific mention in the category title. (It is not even mentioned indirectly because, by the SIC categories and by industry practice, soaps and detergents are not usually considered to be subcategories of either sanitizing agents, polishes, or cosmetics.)

This problem is further compounded when the application, "Detergents, Soaps, and Disinfectants," is listed under the subcategory "Polishes and Sanitizing Agents." In the SIC hierarchy, "Soaps and Other Detergents" and "Polishes and Sanitation Goods" are given equal

status as separate subcategories. The use of the term, "disinfectants," presumably as a replacement for "sanitizers," is a possible source of further confusion. It is used only once in the SIC hierarchy and this is for one small application under "Specialty Cleaning and Sanitation Products," a subcategory treated separately as "Specialty Cleaners" on the Use Classification System applications list.

Some applications that are quite different (e.g., scouring cleansers and presoaks) are combined in the applications list. The Index contains some entries not commonly used in the industry (e.g., "Household Cleaners") yet lacks entries for commonly used application terms (e.g., household detergents, laundry detergents, heavy duty laundry detergents) and lacks cross-references to descriptors in the list (e.g., no listing for "hand cleaners, waterless" comparable to that for "hand cleaners, except waterless").

The choice of the descriptor "Soap Bars and Flakes, and Soap and Detergent Powders" is unfortunate because it prohibits placement of liquid products in this application and no other appropriate application descriptor other than the more general term "Detergents, Soaps and Disinfectants" is available.

Content--The function list contained descriptors that were either identical or very similar to the industry terms for all of the functions chemicals perform in this product category.

Largely because of the rearrangement of the SIC hierarchy, the grouping of applications, and the choice of terms, no application descriptors are available for specific applications that represent major unique uses for chemicals. The absence of (1) a division of detergents into household and non-household, (2) a descriptor for laundry detergents, and (3) the common industry terms, heavy duty, light duty, and liquid detergents, means that classification into the usual industry application areas such as "Heavy Duty Powdered Laundry Detergents" or "Light Duty Dishwashing Liquids" cannot be made and only general application descriptors can be used. Most of these general

descriptors include several types of applications (some of which are entirely unrelated especially in terms of exposure potential).

Utility--The need to use general rather than specific application descriptors for 18 of the total of 55 application descriptors indicates the lack of utility of the applications list to adequately describe the uses of chemicals in this product type. It is difficult to see how classification into these general applications will yield information useful in risk assessment.

The instructions for reporting chemical uses using the Use Classification System mentions that "applications" include chemical processes, products, or activities but no guidance is provided for selecting one of these three types of application when the application could be described as either a process, a product, or an activity. For example, the application for the chemicals in the household laundry detergent products could be classified by the products, as we have done, or they could be classified as the activity, "04122 Laundering," which is defined as including home laundering. (It was noted that another instance of this source of confusion exists with the applications "04123 Rug and Upholstery Cleaning" and "25124 Rug and Upholstery Cleaners." If some users report one way and some the other way, the utility of the resulting information will be in doubt.

The failure to provide a mechanism to add applications to the existing list of specific applications for a product type such as "Household Detergents" appears to decrease the potential utility of the information gathered because such additions must be made to "16 Miscellaneous Products and Services."

Conclusions from the Trial Run on Household Detergents--The following conclusions are evident from the trial run on household detergents:

- Format

The format of the applications list for "251 Polishes and Sanitizing Agents" will need considerable revamping. A

framework is needed to permit the use of descriptors that provide data useful for even the crudest of risk assessments.

- Content

Using a revised format for treatment of the detergent products, a series of new specific descriptors--more consistent with the SIC code and industry usages--will be needed to cover the individual applications in a complete and accurate manner.

- Utility

In its present form, the applications list is inadequate for classifying the applications of the component chemicals that provide functions in the household detergent products. After revamping the format and providing specific descriptors for applications, a more useful tool for characterizing this product type would be available.

Product Type: Rubber Processing Chemicals

The following 46 terms were found to be the ones in most common use within the industry for describing the functions of the component chemicals in rubber processing chemicals:

- | | |
|-------------------------|---------------------------------|
| • Accelerators | • Desiccants |
| • Activators | • Detackifiers |
| • Antiblocking agents | • Devulcanizing agents |
| • Anticracking agents | • Dispersants |
| • Antihydrolysis agents | • Dusting agents |
| • Antiozonants | • Emulsifiers |
| • Antioxidants | • Extenders |
| • Antiscorching agents | • Fillers (reinforcement) |
| • Antistatic agents | • Finishing materials (surface) |
| • Blowing agents | • Flame retardants |
| • Biocides | • Heat resistants |
| • Bloom inhibitors | • Lubricants |
| • Bonding agents | • Modifying agents |
| • Colorants | • Odorants |
| • Corona resistants | • Peptizers |
| • Coupling agents | • Physical property improvers |
| | • Plasticizers |

- Polymerization regulators
- Radiation absorbents
- Reclaiming agents
- Reinforcing agents
- Retarders
- Saturants
- Shortstops and inhibitors
- Softeners
- Stabilizers
- Stiffening agents
- Surfactants
- Tackifiers
- Vulcanizing agents

We found that the evaluation of all uses of rubber processing chemicals by their function/application components would result in extremely long tables with a large amount of repetition. Consequently, with the approval of the EPA Technical Monitor, only two functions--vulcanizing agents and blowing agents--were chosen to be included in the trial run. Vulcanizing agents were chosen because they are used in all rubbers except reclaimed rubber and will have essentially all of the applications associated with them. Blowing agents were chosen as an example of a function with applications that are unique to a specific rubber product type (i.e., sponge-rubber products). The applications in which these two functions are performed as described in industry terms and the trial run assignments to Use Classification System function and application terms are summarized in Appendix C, pages C-46 to C-60.

The problems encountered and the conclusions reached from this part of the trial run are described in this section.

Format--No problems were encountered that were specifically due to the format of the Use Classification System.

Content--Using sources commonly used in the rubber industry, such as the Rubber Red Book, we identified 46 rubber processing function terms. Our list of functions includes those that are unique to rubber processing (such as vulcanizing agents, accelerators, and peptizers) as well as terms for functions performed not only in rubber processing but also elsewhere in the chemical industry (such as biocides, flame retardants, and surfactants). The Use Classification System's list of

functions found under the heading "Rubber compounding agents" includes only 21 functions. Two of the function terms, "Antislip finishing agents" (defined in the functions list as applied to textile fibers or yarns) and "Optical brighteners" (defined as used only in textiles, papers, detergents, and plastics), were inappropriate for inclusion, and the term, "Catalysts," is not unique to rubber processing. Of the 30 function terms on the industry term list that are not included under the heading "Rubber compounding agents," 22 were included elsewhere in the Use Classification System functions list. The majority of these 22 functions are not considered to be unique to rubber processing and thus are correctly excluded from this heading. However, function terms such as "blowing agents" and "anti-scorching agents" are unique to rubber processing and should be included with "Rubber compounding agents." The eight function terms not found in the Use Classification System are general terms, except for "Physical property improvers" and "Polymerization regulators," which are relatively common rubber processing terms. Satisfactory definitions could not be found for the terms, "Pre-vulcanization inhibitors" and "Vulcanization leveling agents," that were in the Use Classification System but did not appear on the industry term list. Thus, in spite of the apparent significant difference in the number of terms between the two lists, the Use Classification System's list of function terms is not considered to be inadequate coverage of rubber processing functions.

A very common application of rubber is in the manufacture of gaskets and sealing devices. In the Use Classification System, the application, "Gasket, packing and sealing devices" exists only as a subheading under "Stone, clay, ceramic, glass and concrete products." Because of the limitation on this latter subheading to the materials in the major heading, a general application term for rubber products, "Mechanical rubber goods," had to be used for rubber gaskets and seals.

Another common application of rubber is in the manufacture of automotive parts. This application and its subcategories were usually included in the general category of "Motor vehicles and equipment." For example, automotive spark plug boots and power steering hose liners

and jackets were classified in this manner, because there is no classification for rubber products used for motor vehicles and equipment; however, plastic products for motor vehicles are explicitly defined as being included in the three-digit code, "Industrial plastic products."

In addition, the classification of rubber automotive parts presents a problem in the choice of application terms. For example, automotive primary and ignition wire coatings could be classified as either "283 Motor vehicles and equipment" or "0655 Miscellaneous fabricated wire products." Automotive steering hose liners and jackets could be classified as either 283 or "075 Rubber and plastic hose and beltings." In both examples, the specificity of the two appropriate application terms is equivalent. In instances where there were choices of EPA application terms, both applications were entered in the trial run in order to point up the problem. Similar double entries were made in the cases of "280 Aircraft and parts" vs. "075 Rubber and plastic hose and belting," 280 vs. "0710 Mechanical rubber goods," "1493 Food processing machinery" vs. 075, and "286 Railroad cars and equipment" vs. 075.

Two additional application terms needed as subheadings under "Miscellaneous fabricated rubber products" are terms for rubber insulation and for miscellaneous fabricated cable products. Wire and cable insulation is a common application of rubber, but no appropriate term exists in the applications list. The insulation application terms that are included in the Use Classification System are limited to asbestos, foamed plastic, insulation board, and mineral wood products.

Rubber rollers are used to apply lacquer, paint, and inks; however, there is no appropriate specific application term for rollers in the Use Classification System. Although we found that the SIC Code System includes paint rollers under "Brooms and brushes," this did not seem appropriate. Therefore, because the Use Classification System listed "rolls" under "Mechanical rubber goods," rollers were assigned to this application.

The specificity of available application terms does not seem consistent among the general application headings. For example, medical

applications of rubber include surgical implants, prosthetic devices, and dental impressions. The most specific application term available in the Use Classification System is the three-digit code "Medical and dental instruments and supplies." In contrast, "Food and kindred products" seems to have been assigned numerous specific four-digit code subheadings for applications (e.g., "Dairy products" includes "Butter," "Cheese," "Condensed and evaporated milk," "Fluid milk products," and "Ice cream and frozen desserts" as subheadings).

Utility--The Use Classification Systems is basically consistent with the SIC classification of rubber and plastics products. However, its utility is diminished by two factors: (1) the lack of specificity of subheadings and (2) the lack of opportunity to add subheadings to the appropriate 2-digit code lists (rather than adding terms only to "Miscellaneous products and services").

Identification of the uses of rubber products using industry terms was achieved quite easily. The uses were defined more specifically than the Use Classification System terms permitted. This lack of specificity in the application terms diminishes the utility of the system by limiting the choice of terms. The net result was that classification of many applications had to be done by very general terms even though more specific information was available.

The lack of opportunity to add subheadings to the list of headings in each 2-digit code listing reduces the quality of the data that is produced. For example, because seals and gaskets are common rubber products, it would seem appropriate to be able to add the application "Gasket, packing, and sealing devices" (as it is shown under "Stone, clay, ceramic, glass, and concrete products") to the "Fabricated rubber and plastic products" list rather than be limited to the more general term "Mechanical rubber goods." The alternative of using the term "Miscellaneous Products and Services" seems even less desirable because the fact that it belongs with the fabricated rubber products could not be brought out.

Conclusions from the Trial Run on Rubber Processing Chemicals--
The following conclusions are evident from the trial run on rubber processing chemicals:

- The trial run for classifying rubber processing chemicals was relatively straightforward for uses that involved applications in fabricated rubber products, once it was realized that only general terms were usually available for classifying applications where more specific information was available. When the uses were described in industry terms as particular fabricated rubber products used in the products of another industry, e.g., radiator hose in automobiles, then the format and the instructions created confusion as to how best to classify a use. In the example cited, a case could be made that the user would be using the more specific term by classifying the application as "075 Rubber and plastic hose and belting" or as "283 Motor vehicles and equipment." Guidance in the instructions for handling such cases would help to achieve consistent reporting of the same uses.

- Content

The application descriptors should be more specific, to take advantage of the detailed information that is available on rubber products.

The level of detail of the application descriptors as provided by subheadings should be made more consistent among the various 2-digit code categories, particularly where logical subheadings are available from the descriptions provided as parenthetical explanations of the application terms.

It would be helpful if the user were able to add subheadings to the lists for the individual 2-digit code categories rather than being required to add such applications under "Miscellaneous products and services."

- Utility

The Use Classification System instructions call for the user to report the product in which a chemical is used, which has been done in this trial run on vulcanizing agents (e.g., coated fabrics). However, such a classification loses what may be a more important bit of information for assessing the extent of human exposure to the vulcanizing agent, namely, the type of elastomer (polybutadiene, silicone, etc.) produced by the use of the vulcanizing agent and used to coat the fabric. This failure to provide a method by which both the elastomer type and the fabricated rubber product can be included in the classification of the use appears to be a significant shortcoming of the Use Classification System when used to classify rubber processing chemicals.

Product Type: Trade Sales Paints

The following nine terms and their subdivisions were found to be the ones in most common use within the industry for describing the

functions of the component chemicals in trade sales paints:

- Antifoaming agents
- Antiskinning agents
- Driers
- Pigments
 - Colored and black
 - Corrosion inhibitors
 - Extenders (nonopaque)
 - White (opaque)
- Preservatives and mildewcides
- Propellants
- Resin binders (film-forming agents)
- Solvents
- Surfactants and dispersing agents
- Thickeners.

The applications in which these functions are performed as described in industry terms and the trial run assignments to Use Classification System function and application terms are summarized in Appendix C, pages C-61 to C-69.

The problems encountered and the conclusions reached from this part of the trial run are described in this section.

Format--No problems were encountered that were specifically due to the format of the Use Classification System.

Content--Trade sales paints include some aerosol products that contain chemicals functioning as propellants. In the Use Classification System, no application such as "Aerosol paints" exists. The closest application to be found is "Interior oil base paint products," although the SIC Code System includes a separate heading for aerosol paints in the category "Paints and allied products." Because the Use Classification System appears to be based on the SIC System, aerosol paints seem to have been overlooked.

From the industrial point of view, shellacs are normally classified with varnishes and the SIC Code System includes them there. However, the Use Classification System does not classify shellacs as

related to varnishes. In fact, only "Bleached shellacs" are listed, and only under "Miscellaneous related paint products," along with such products as pigment dispersions and ink vehicles. As a consequence of these changes, it is difficult to know how to classify shellacs as an application.

The absence of the term "trade sales" from the major headings under "Paints and allied products" (e.g., "Exterior oil type paint products") is misleading. The SIC System views the products not listed under "Industrial product finishes" as trade sales products and includes "trade sales" in its terminology. The paint industry considers the distinction important because some industrial uses are very similar to trade sales uses and could be misclassified if the distinctions were not worded clearly. This could result in a specialty industrial interior paint product (e.g., a special formulation for special conditions such as high temperature) being classified as an ordinary trade sales interior wall paint.

Function terms also seem to differ between the industry and the Use Classification System. What the industry would term as "antifoaming agents" could be classified on the function list as "defoamers" or as "foam inhibitors." According to the function definitions in the Use Classification System, defoamers are a function related to treatments or processes while foam inhibitors are related to liquid products. However, the manufacture of antifoaming agents is not necessarily going to make these distinctions nor is the manufacturer likely to know whether the chemical will be used in processes or products.

In the Use Classification System, pigments are classified as a subdivision under coloring agents. However, the industry refers to pigments not only as coloring agents but also as extenders and corrosion inhibitors. The Use Classification System recognizes and lists these other functions at the same level as coloring agents but classifies pigments as a subset of coloring agents, thereby reversing the usual industry hierarchical scheme.

The industry uses both "resin binders" and "film formers" as terms for the principal chemical base of a paint; however, a user of

the Use Classification System may misclassify functions if he chooses to pursue "resin binders" rather than "film formers." "Resin binders" is not included in the Index to the Use Classification System; however, the term "binders," which seems likely to come to mind, is included and, in general, the definition given to the function "binders" appears appropriate for the function of resin binders in paints. "Film formers" is listed in the Index and the user is referred to the function "Coating agents." Depending on the choice of industry terminology and the reporter's technical knowledge, the use of the term "resin binder" may lead to a different classification of the function, i.e., the same function may be classified as "Binder" or "Coating agent."

Utility--According to the instructions for reporting an application, the most appropriate and specific term should be chosen. Determining the appropriate level of specificity can present a problem. For example, the application, "Automotive and machinery refinish paints and enamels," characterizes a group of paint products. Chemicals are used in formulating the paint, which is subsequently used for particular purposes. A more complete description of the use of these paints can be made by citing "Motor vehicles and equipment" as an application because it describes the resultant use of "Automotive and machinery refinish paints and enamels." However, such a description may be more detailed than intended by the EPA. Page 1 of the instructions touches upon this issue but does not provide clear guidance for determining appropriate levels of detail.

The instructions give directions for the addition of a miscellaneous application not found on List II. The Use Classification System directs such applications to a whole class labeled "Miscellaneous products and services." However, it may sometimes be appropriate to add an unlisted application to an already existing class. For example, if one wanted to add aerosol paints as an application, the instructions do not presently provide a procedure by which the addition could be included in the class, "Paints, coatings and allied products."

Conclusions from the Trial Run on Trade Sales Paints--The following conclusions are evident from the trial run on trade sales paints:

- Format

The trial run for classifying trade sales paints was relatively easy because the SRI formulation data was organized on the SIC code pattern and this appears to have been the basic organization of the Use Classification System applications (although some exceptions were noted). The alphabetical system for organizing the function and application lists made the term search relatively easy.

- Content

Existing application descriptors should be more inclusive or new application descriptors should be added to cover applications found to be unlisted. The cases of aerosol paints and shellacs, other than bleached, are examples of unlisted applications.

The EPA application terms seem to be fairly accurate when they follow the SIC breakdown of products. Problems are encountered, however, when SIC terms are rearranged. Examples of such rearrangements are: (1) the case of shellacs no longer being associated with varnish and (2) the removal of the term "trade sales" from the major headings under "Paints and allied products."

The Use Classification System may present function terms at a level of detail that is greater than that used by industry. For example, as the industry defines the function of an antifoaming agent, the distinction between defoamers and foam inhibitors is blurred, but the function Index requires that the function be reported as only "Defoamers" or only "Foam inhibitors." These two functions are assigned function codes that are not related numerically, (i.e., 160 "Defoamers" and 246 "Foam inhibitors"), thereby making them appear to be unrelated. To allow the option of reporting both definitions of antifoaming agents, the term "Antifoaming agents" could be assigned a function code, and "Defoamers" and "Foam inhibitors" could be assigned four-digit codes and listed as subsets of "Antifoaming agents."

This discussion raises the larger question of whether there are other cases where the Index requires single terms that are subsets of the terms normally used by the industry.

Inorganic pigments, according to the industry, function as extenders and corrosion inhibitors as well as coloring agents, while organic pigments function only as coloring

agents. However, in the Use Classification System, "Pigments" are listed as a subset of coloring agents. The function hierarchy would be more consistent with the industry if a new function, "Inorganic pigments," was added and assigned a three-digit code with its own subsets. The subsets would be (1) "Corrosion inhibiting pigments," (2) "Extending pigments," and (3) "Coloring pigments." "Coloring agents" would be changed to "Organic coloring agents" with the subset "Dyes" and "Organic pigments."

- Utility

The function and application lists should not be expected to be 100% complete. Therefore, instructions should be included to direct the addition of new or miscellaneous applications to their generic category rather than directing the user to "Miscellaneous products and services."

The SIC numerical breakdown of manufactured products, as contained in the 1977 Census of Manufactures Numerical List of Manufactured Products, published by the Bureau of the Census, is a helpful aid to understanding the application terms as listed in the Use Classification System. With this publication in hand, a reporter can understand some of the assumptions behind the EPA descriptors, because the Use Classification System is principally based on the SIC System. For example, it will direct the reporter to note that the SIC terms, "Sash, trim, and trellis enamels and tinting bases" or "Porch and deck enamels and tinting bases, including interior-exterior floor enamels" belong to application 1802 "Exterior house paints." It will also aid in finding that shellacs, except bleached, may have been intended to be associated with varnishes, and indicate a need to add a category such as aerosol paints.

Subtask C: Overall Evaluation of the Use Classification System

In this subtask, the positive and negative features of the Use Classification System were assessed, based on information obtained in the other two subtasks and on a separate study of the following five parts of the system:

- Instructions for Reporting Chemical Uses
- List I (Functions)
- Index to List I
- List II (Applications)
- Index to List II.

The results of this overall evaluation are described in this section. The assessment of each of the five parts focuses on the three areas of greatest concern to the EPA (as identified by the EPA Technical Monitor), namely, format, content, and utility.

Instructions for Reporting Chemical Uses

The instructions reviewed in this part of the subtask, supplied by the EPA Technical Monitor in May 1979, are reproduced in Appendix D of this report.

Format

The format of these instructions is straightforward and understandable. No problems attributable to the format occurred during the trial runs.

Content

It is assumed that an introduction, describing the background of the development of the Use Classification System and indicating how the information provided will be used by the EPA, will precede the instructions for reporting chemical uses in the package of material supplied to manufacturers, importers, and processors. Such an introduction is considered essential to achieving the desired quality of input from the reporting firms.

In Section 2.1, Definition of Chemical Use (Page D-3 in Appendix D) the explanation of the term "function" cites "adhesives" as the first example. This is an unfortunate choice because many if not all users are likely to consider adhesives as an application for chemicals rather than as a function. In fact, the instructions later cite "adhesives" again, but as an example of an application for a chemical. Use of a different function example without this confusing aspect is recommended.

Section 2.2.1 (page D-4) directs the user to look for an appropriate "term (or terms)" for the function. No explanation is given for

the inclusion of "(or terms)" and it appears to be in conflict with the instructions in Section 2.4.4 (p. D-11), which state that one function term should be chosen rather than reporting two alternative terms.

Section 2.2.2 (p. D-5) indicates that a few function term codes contain letters, but no such codes were found in the list of functions. However, many function codes include a plus (+) sign or an asterisk (*) or both and no explanation of these symbols is provided in the instructions.

Section 2.2.3 (p. D-7) states that a definition must be provided for all new terms added to "315 Other," but no information is given about where this definition is to be added or what it should include. The latter is particularly important because the user could be asked to: (1) name any three-digit function terms under which the new term would fall or (2) name the function term to which the new term is most closely related. Such information would help in adding the new term to the functions list in its proper place.

Section 2.6.2 (p. D-13) indicates that use of nitrobenzene to make aniline should be reported by using the function term "chemical intermediate," which is consistent with industry usage of this term. However, the definitions of "chemical intermediates" and "chemical raw materials" in the list of functions are not consistent with this usage. These definitions would require that the nitrobenzene be described as a chemical raw material when used to make aniline. This situation is created by the definition of "chemical intermediates," which is far more restrictive than its meaning as normally perceived in the industry.

In Section 2.1 (p. D-3), the term "application" is defined as "what a chemical is used in--a chemical process, product or activity in which the chemical is employed" and "petroleum distillation" is cited as an example of a chemical process. It is recommended that either "chemical process" be shortened to "process" (as is done in Section 2.5, p. D-11) or that a different example be cited, because "petroleum distillation," although a "process," is not usually considered to be a "chemical process."

The explanation of defining chemical use as a combination of a function and an application continues by stating: "For example, a chemical may function as a soil release agent for application to yarns and fabrics." This use of the word "application" is not in keeping with the definition given just above and is likely to confuse the reader. It is recommended that this sentence be reworded to say "in the application 'finished textile products.'"

The next example cited in the explanation (p. D-3) is likely to cause even more confusion. After stating that a production or formulation operation should not be reported as a use if it results in a product that does not contain the chemical being reported, the example cited appears to contradict this instruction. The use of acrylonitrile as a polymerization monomer to make polyacrylonitrile, which is used to formulate coatings for yarns and fabrics, is explained as requiring that the function be reported as a monomer and the application be reported as finished yarns and fabrics. Most users would likely consider that both polyacrylonitrile and any coating formulation containing it do not contain acrylonitrile (even though trace amounts admittedly could be present). Consequently, whether the application term "213 Plastic materials and resins" (to cover the product polyacrylonitrile) or "2701 Other finished fibers, yarn and fabrics" (to cover the coated yarns and fabrics) is used, the directions are not being followed. Further, this example raises several other problems: (1) the recommended application "finished yarns and fabrics" is not a valid term from List II; (2) if the combination "1290 Monomers" and "2701 Other finished fibers, yarn and fabrics" is reported as describing this use, then the fact that the polyacrylonitrile was used as a coating on the yarns and fabrics will be completely lost because use of the polyacrylonitrile to make the yarns and fabrics themselves, rather than just the coatings, would also be reported by using the same combination, and (3) as illustrated by this example, the statement (p. D-4) that each unique combination of a function and an application constitutes a distinct

use is not accurate if the application term selected is not specific enough to characterize the uniqueness of the particular application.

Section 2.3.1 (p. D-7) directs the user to look for an appropriate "term (or terms)" for the application. No explanation is given for the inclusion of "(or terms)" and it appears to be in conflict with the instructions in Section 2.4.4 (p. D-11), which imply that only one application term should be chosen.

Section 2.4.1 (p. D-9) describes the procedure for adding a new application term but does not require that a definition of the term be provided. This is a serious oversight because the user could be asked to: (1) name any application terms already in the list under which the new term would fall or (2) name the application term to which the new term is most closely related. Such information would help in adding the new term to the applications list in its proper place.

Section 2.5, Special Situation Rule for Using a Double Function, states that a chemical may have another function as its application and cites a use where a solvent is used to formulate an adhesive as an example because the term "adhesive" is used to describe a function in the Use Classification System. This so-called "double function" is an artificial construction necessary to counteract the results of using terms to describe functions that are normally used solely to describe applications (most frequently formulated or unformulated products). It is recommended that consideration be given to revising the list of function terms by using the suffix "-ing" and the word "agent" as part of the term and freeing the existing terms for use in the applications list. A review of the combinations published in the Federal Register on July 25, 1978, provided the following limited number of examples of the types of changes being suggested here:

<u>Function Term Used As Application in Federal Register</u>	<u>Proposed Replacement Function Term</u>
Lachrymators	Lachrymating agents
Sealants	Sealing agents
Coolants	Cooling agents
Dyes	Dyeing agents
Fertilizers	Fertilizing agents
Lubricants	Lubricating agents

The further explanation (p. D-11) of the example of using a double function, after indicating that "adhesive" is the appropriate application term, states parenthetically that the adhesive may later be used to laminate materials such as fabrics and as such would have a valid application in the context of the system. This parenthetical statement was the source of considerable confusion in carrying out the trial run. If "adhesives" is the acceptable application term, what is the relevance of the subsequent use of the adhesive in laminating fabrics? If laminating fabrics is the "ultimate" application, why not list "270 Finished textile products" and dispense with "adhesives" altogether? Taken together with the example of acrylonitrile (p. D-3), the reader is likely to be completely confused about whether he should cite the first product in which the chemical performs its function or follow it through subsequent steps to the ultimate product. In the first instance, information is gained on the immediate fate of the chemical but nothing is learned about the final product in the chain. In the second instance, information on the nature of the early products in the sequence (e.g., the type of polymer used to make a plastic part) is lost. If the chain is carried through fabricated products such as rubber radiator hose all the way to a "final product" such as "283 Motor vehicles and equipment," then even the nature of the fabricated product is lost. A constant bombardment of questions concerning the proper application terms to use may result if considerably more guidance is not provided in the instructions.

In addition to indicating how far the user should go down the product chain, further clarification is needed on the criteria to be used when choosing between a process, a product, and an activity. One example of this problem would be a chemical intended for use as a bactericide in a disinfectant product used in cow barns. Assuming that the proper function term is "102 Bactericides," the choice of application term could be made from (at least) the following possibilities:

F 1020	Bactericidal cleaners (cleaning agents that contain bactericides)
F 190	Disinfectants (substances used on inanimate objects that destroy or inhibit microorganisms but not bacterial spores)
25100	Dairy, farm and food plant cleaners and disinfectants
0150	Dairy farming (includes indirect operations involving the physical plant, e.g., barn disinfecting)

In the absence of satisfactory guidelines, this one use might be reported in four different ways.

Utility

The instructions provide useful directions for carrying out the mechanics of the classification process. Because of the confusion likely to be created by the examples cited in the explanations, the instructions are not likely to assist the user in arriving at the proper function-application combination, however. This problem is not viewed as insurmountable. In fact, the quality of the explanations and examples could be upgraded to a level where any failure of a user to classify a chemical's uses properly would probably be due to inadequacies of the indexes to the lists and of the lists themselves rather than to deficiencies in the instructions.

List I (Functions)

The list of functions reviewed in this part of the subtask was supplied by the EPA Technical Monitor in May 1979 and consisted of

50 typewritten pages on which valid function terms were listed along with their definitions and code numbers. Although six random terms are included at the end of the list, the remainder is in alphabetical order except for a limited number of more specific function terms placed at a second level of hierarchy as subsets of more general function terms. The hierarchy has no third level and no general term has more than eight subset terms listed under it. The code numbers are in numerical sequence from 001 to 425 (except for two missing numbers) at the higher level of the hierarchy. The subset terms are listed in alphabetical order under the more general terms and assigned consecutive code numbers by the addition of a fourth digit (starting with zero) to the three-digit code of the general function term (e.g., the subsets of the general term coded as 117 are coded as 1170, 1171, 1172, etc.)

Format

The listing of functional terms in alphabetical order and the use of code numbers, which appeared at first to make the functions list easier to use, were found on further consideration to be a source of future problems. When the new function terms reported under "315 Other" are incorporated into the list, either the code numbers of existing functions will need to be revised or the alphabetical listing will need to be abandoned (as has already been found necessary for functions 420-425 at the end of the current list).

The code numbers appear to be necessary only because of the two-level hierarchy of the list (i.e., if all function terms were on a single level, they could all be listed in alphabetical order and the Index could direct the user to them on the basis of their names alone). However, the necessity for the hierarchy is not explained in the instructions or elsewhere. Examination of those entries in the functions list where the hierarchy has been employed indicated that the hierarchy could be eliminated by merely adding cross-references to the functions Index, which would direct the user to the other terms now listed in the hierarchy either above or below the listed term.

In some cases, the more general term might even be eliminated from the functions list (but not the functions Index) because it appears to be either: (1) an artificial combination of several functions with, at best, a tenuous relationship (e.g., "003 Absorbents," "128 Chemical intermediates," and "291 Leveling agents"), or (2) unnecessary, because the listed subset term or terms describe all the functions covered by the general term (e.g., "019 Analgesics," "117 Cardiovascular agents," "141 Coloring agents," "178 Dermatologicals," "244 Fluorescent agents," "245 Fluxing agents," "257 Fungistats," "263 Heat transfer agents," "265 Hematological agents," "281 Insulating materials," "308 Nutrients," "314 Ophthalmologicals," "327 Pesticides," "343 Psychotropics," "369 Sequestrants," "390 Strippers," and "409 Uterine contractants").

Some general terms were found to contain one or more subset terms that did not qualify as subsets according to the definition of the general term (e.g., "102 Bactericides," "109 Blowing agents," "137 Cloud point depressants," "175 Deodorants," "275 Immunological agents," "393 Surfactants," "396 Tanning agents," and "310 Odorants").

The utility of still other general terms is questionable because the definitions given indicate that the subset terms shown represent only a portion of the terms (some of which are listed elsewhere in the functions list), which could, or should, be listed, e.g., "118 Carriers," "157 Dechlorinating agents," "187 Dietary supplements," "223 Extenders," "282 Intensifiers," "293 Lubricating additives," and "386 Stabilizers".

Content

The completeness of the hierarchy is brought into question by the lack of subset terms for those numerous function terms that are specifically defined as combinations of two or more functions. These terms are listed in order of code numbers in Appendix E. Although having two or more functions included in one function term admittedly shortens the list of terms, it means that the information reported by the users will not be as specific as it would be if individual terms were used.

The EPA will not know which of the functions covered by the general function term is the actual function performed by the chemical.

The hierarchy is used much more extensively for function terms related to pesticides and drugs than for other function terms, but no explanation is given for this. Because these two areas are covered by other legislation, one would think that these non-TSCA functions would be presented with equal or less detail, not greater detail, than functions covered only by TSCA.

The following additional aspects of the content of the functions list were noted in the course of reviewing the individual function terms:

- The definition of "023 Anticaking agents" would seem to include "226 Fertilizer conditioners" as a subset.
- One component in the definition of "075 Antiprecipitants" appears to include the function covered by "150 Crystal distortion agents."
- The function term, "283 Ion exchange compounds," could be subdivided into "Ion exchange resins" and "Liquid ion exchange agents."
- The function, "183 Detergent builders," is defined as including builders for soap but a separate term, "376 Soap builders," is also listed.
- There is no entry for the function term, "Stickers," which is commonly used in the pesticides industry.
- The definition of "180 Desiccants" does not cover the function of chemicals used to dehydrate plants.

During the trial run, the function term, "Ripening agent," which is commonly used in the industry, was found not to be included in the functions list and the definitions of the following function terms were found to be incorrect:

- 1411 Pigments (defined as a subset of coloring agents but some are extenders or corrosion inhibitors)
- 3933 Flotation agents (definition is for a collector; the term flotation agent is a general one that includes activators, collectors, depressants, flocculants, frothers, and modifiers, many of which are not surfactants)
- 356 Rubber compounding agents (defined as including two inappropriate functions--antislip agents and optical brighteners)

Utility

The utility of the current functions list is diminished by the variable usage of the hierarchical system for listing the functions. Abandoning the hierarchy appears to be the best way to improve the usefulness of the list and this would also simplify the job of adding new functions as they are reported. If the hierarchy is to be retained, then considerable modification would be needed to assure that it will provide the users with a satisfactory method for characterizing the functions of chemicals.

Index to List I

The Index reviewed in this part of the subtask was supplied by the EPA Technical Monitor in May 1979 and consisted of 48 typewritten pages on which function terms (including code numbers for valid function terms from List I) were listed in alphabetical order along with appropriate cross-references when needed. For function terms not included in List I, the user is directed to see the valid function term or terms that are used in List I instead of the listed term. The user may also be directed to valid function terms that are considered to be related to the listed term.

When cross-references are included for valid terms, the user is directed to see also a limited number (up to 13 in one case, but usually only 1-3) of other valid function terms that are related to the listed term. The code numbers for these valid terms are included. The Index does not identify those valid function terms in the list that have other valid terms as subsets as a result of the hierarchy of the functions list. The only indication given in the Index that a valid function term is a subset of another term is the fact that the subset terms have four-digit code numbers. The user does not learn the term under which the listed term is a subset until the function list itself is consulted.

Format

The alphabetical listing of all function terms makes the Index quite easy to use. As stated in the instructions (p. D-4), all terms are listed in direct (e.g., Cyclic Chemicals), rather than inverted form (e.g., Chemicals, Cyclic). Although the exclusion of inverted terms results in a shorter Index, a shorter list may well make the Index more difficult to use than a longer list, which would lead the user directly to the correct function term with less searching for the proper term.

Because the two-level hierarchy of the functions list requires that code numbers of valid function terms be included in the Index, these code numbers will need to be revised when new function terms are added to the functions list. Elimination of the hierarchy would permit deletion of the code numbers from the Index. If this were done, cross-references would be needed from function terms to all other function terms currently listed as their subsets in the hierarchy and vice versa. This would probably aid the users, because related terms could then be noted while searching the Index rather than not becoming apparent until the functions list was consulted.

Content

The failure to show in the Index the valid function terms that are above and below the listed term in the functions list hierarchy is undoubtedly based on the belief that the users will note the relationships when the functions list is consulted. However, because this may not be the case, the inclusion of cross-references to such related terms in the Index may be at least as useful as the cross-references to other terms not associated with the listed term in the hierarchy.

Numerous function terms are defined in the functions list as containing functions that are not listed separately in the second level of the hierarchy of the functions list. These functions are not listed in the Index with a cross-reference to the appropriate valid function term (e.g., "Minerals" is included in the definition of "187 Dietary

supplements" but is not listed in the Index; other examples can be found in the definitions for the function terms listed in Appendix E). In some cases, these functions appear in the function term definition as a lengthy description (e.g., "materials added to plastic forming compounds to prevent discoloring of the final product upon aging" is contained in the definition of "049 Antifogging agents"). However, the potential usefulness of having such information available in the Index would seem to outweigh the work involved in converting the descriptions to brief Index entries.

Although the function term, "020 Analytical and product testing agents," appears in the Index, there is no entry in the Index for "Product testing agents" with a cross-reference to the valid function term.

To further clarify how the function term, "315 Other," is to be used, consideration should be given to the addition of Index entries for "Functions not listed," "Miscellaneous functions," and "Unknown functions," with appropriate cross-references to "315 Other."

The following additional aspects of the content of the functions Index were noted in the course of reviewing the individual entries:

- No explanation is given for the plus (+) signs and asterisks (*) that precede many entries in the Index.
- No entries for "Smoke screens" giving a cross-reference to "309 Obscuring agents" or for "Liquid ion exchange agents" with a cross-reference to "283 Ion exchange compounds."
- No cross-references between "023 Anticaking agents" and "226 Fertilizer conditioners" and no cross-reference from "166 Dehumidifiers" to "167 Dehydrating agents."
- Incorrect cross-references from "393 Surfactants" to the unrelated "218 Evaporation control agents" and from "Depressants" to "3937 Wetting agents."

During the trial run, the following items were noted with regard to the content of the functions Index:

- No entries for the common term "Perfumes" giving a cross-reference to "3100 Fragrances" or for the common term "Resin binders" with a cross-reference to "140 Coating agents."

- No cross-reference from "Suds control agents" to "3861 Foam stabilizers."
- Incorrect cross-references from "Collectors" to "250 Frothing agents" and from "105 Bleaches" to "110 Bluing agents" and "2440 Optical brighteners."

Utility

The utility of the current functions Index is diminished considerably by the absence of entries in inverted form, an indication of the function terms above or below the listed term in the function list hierarchy, and functions contained in the function terms in List I but which are not listed separately in the second level of the functions list hierarchy. An Index containing these additional entries would probably permit quicker, more useful classifications by users.

List II (Applications)

The list of applications reviewed in this part of the subtask was supplied by the EPA Technical Monitor in May 1979 and consisted of 41 typewritten pages on which valid application terms were listed along with their descriptions and code numbers. The list is presented in a four-level hierarchy. A new page is started for each of the 28 first-level application terms, which are listed in alphabetical order and have code numbers in numerical sequence from 01 to 28. The terms at the other levels are listed in alphabetical order under the more general terms and assigned consecutive code numbers by the addition, starting with zero, of a third digit for the second-level terms, a fourth digit for the third-level terms, and a fifth digit for the fourth-level terms. The first-level terms have two to ten second-level subsets. Some second-level terms have no third-level subsets but one ("273 Miscellaneous textile products") has eleven, which has necessitated the use of a letter in place of the fourth digit (i.e., "273A Tire cord and fabrics"). Most third-level terms have no fourth-level subsets and only one ("2512 Specialty cleaners") has as many as nine such subsets.

Format

The listing of application terms in alphabetical order with consecutive code numbers will be a source of problems when new applications are added. Either the code numbers of existing applications will need to be revised or the alphabetical listing will need to be abandoned. Because of the multilevel hierarchy of the applications list, eliminating the hierarchy (as suggested earlier for the functions list) does not appear to be a feasible way of solving this problem. If the use of code numbers is considered necessary, abandonment of the alphabetical listing would allow additions to be made as needed. The resulting system would then be very similar in format to the SIC Code System upon which the applications list appears to be based.

Content

List II includes no applications for products covered by the SIC Major Group 21, Tobacco Products, or for the coal-derived products included in SIC Major Group 29, Petroleum and Coal Products. Their absence is not explained nor are the plus (+) signs and asterisks (*) that follow many function code numbers.

Although the four-level hierarchy would appear to provide ample opportunity to identify applications in very specific terms, the hierarchy is used in a highly variable way. Further, no evidence is given of the guidelines used to select the level of detail provided.

At the one extreme are the two-digit terms, "05 Drugs and other pharmaceuticals" and "02 Chemicals." The only subsets of the former are human and veterinary drugs and the latter has only two subsets, "020 Inorganic chemicals" and "021 Industrial organic chemicals," one of which has no subsets and the other has only three (there is no fourth-level hierarchy). This treatment of drugs is not consistent with the considerable detail provided in List I for the functions of chemicals used as drugs and it does not use the readily available subcategories provided by either the SIC Code System or the U.S. International Trade

Commission's annual publication "Synthetic Organic Chemicals, U.S. Production and Sales."⁽¹⁾ These same two sources also provide bases for subdividing chemicals into numerous more specific categories.

At the other extreme, two SIC Major Groups--"35 Machinery, Except Electrical" and "36 Electric and Electronic Equipment"--have been combined in the two-digit function term, "14 Machinery and equipment." The result is three pages of listings with ten subsets at the second hierarchy level, up to ten subsets at the third level, and as many as five subsets at the fourth level. Even with this much detail, some terms at the third level are defined as combinations of applications (e.g., "1463 Engines and turbines"), yet do not have subsets at the fourth level.

Although the above-described treatment of "14 Machinery and equipment" illustrates a desire to shorten the applications list by combining major groups, it also illustrates a desire to provide very specific applications by means of the multilevel hierarchy. The instances of steps taken to combine and shorten the list are much more prevalent throughout the whole applications list than cases where subdivision into specific applications has been carried out. Numerous examples of the following two situations were noted:

- The name of the application term indicates that it includes more than one application (e.g., "0703 Phonograph records and recording tape" and "0715 Rubber floor and wall coverings"), but no subsets are listed.
- The name of the application term is followed by an explanation of the applications that are included (sometimes for as many as ten applications, e.g., "0710 Mechanical rubber goods"), but no subsets are listed.

These procedures have the net effect of shortening the list while making it much more difficult for the user to find the most

(1) U.S. International Trade Commission, Synthetic Organic Chemicals, U.S. Production and Sales, U.S. Government Printing Office, Washington, D.C.

appropriate application term. By providing mostly general terms, these procedures also increase the chance that an application for which the user has a specific description will be classified under one of the general terms and valuable information about the specific application will be lost. (This occurred on many occasions during the trial run.) Because of the numerous slots available in the hierarchy, the separate functions mentioned in application terms that are actually combinations of applications and in parenthetical explanations of the application terms should be listed individually.

The SIC Code System also combines two or more product types into one category, which is undoubtedly the source for many of the application terms that describe multiple applications. However, many other combinations appear to have been constructed for the current applications list, and the SIC hierarchy has been adjusted in the applications list hierarchy to accommodate these combinations. Several common results are: (1) unrelated products may be combined (e.g., "25104 Scouring cleansers and presoaks"), (2) whole SIC categories may be lost (e.g., liquid heavy duty household detergents) and the products covered by them must be described by general application terms, and (3) terms are misclassified as subsets of other terms (e.g., in common usage, "2510 Detergents, soaps and disinfectants" is not considered a subcategory of "25 Sanitizing agents, polishes and cosmetics"). For the user of the applications list who is familiar with the SIC Code System and hopes to use it to assist in correctly classifying applications, these changes (particularly when combined with the change to alphabetical listing of the subset terms) are likely to cause considerable confusion.

The following additional aspects of the content of the applications list were noted in the course of reviewing the list:

- No explanation is given for the plus (+) signs and asterisks (*) that precede many entries in the list.
- The definition for "021 Industrial organic chemicals" includes the following parenthetical explanations:

"(does not include plastic materials and synthetics.)"
The term, "plastic materials and synthetics," appears to be a shortened version of the valid application term, "21 Plastic and rubber materials and synthetics (not fabricated)," which has second-level subsets for "210 Cellulosic manmade fibers," "211 Natural rubber," "212 Noncellulosic organic fibers," "213 Plastic materials and resins," and "Synthetic rubber." If the intention of the parenthetical explanation is to point out that all of these applications are excluded, then the complete valid application term, "21 Plastic and rubber materials and synthetics (not fabricated)," is needed to convey this thought.

- The definition of "05 Drugs and other pharmaceuticals" includes a parenthetical explanation that the definition "includes medicinal chemicals." However, the fact that "medicinal chemicals" are excluded from "02 Chemicals" is not stated in a parenthetical explanation of that application term.

Utility

The utility of the present applications list is severely limited by: (1) the absence of some major product groups; (2) the variable usage of the hierarchy in subdividing major application categories; (3) the use of application terms that combine several applications but that do not have subsets in the hierarchy; (4) the absence of subsets for applications mentioned in the parenthetical explanations of application terms; (5) unusual combinations of application terms and questionable hierarchies constructed to accommodate them. Consequently, the job of using the applications list to locate the most appropriate application term is particularly burdensome. Further, the likelihood is very high that the selected term will be far more general than the detailed information that the user could report if an appropriate specific application term were provided in the applications list.

Index to List II (Applications)

The Index reviewed in this part of the subtask was supplied by the EPA Technical Monitor in May 1979 and consisted of 71 typewritten pages on which application terms (including code numbers for valid application terms from List II) were listed in alphabetical order along with

appropriate cross references when needed. For application terms not included in List II, the user is directed to see the valid application term or terms listed in List II that are most closely related to the listed term. For valid terms from List II, the user may be directed to see also a limited number (up to six in one case, but usually only one to three) of other valid application terms that are considered to be related to the listed term. The code numbers for these valid terms are included.

The Index does not identify those valid terms in the list that have other valid terms as subsets because of the hierarchy of the applications list. The only indication given in the Index that a valid application term is a subset of another term is the fact that the subset terms have three-, four-, or five-digit code numbers. The user does not learn the term under which the listed term is a subset until the applications list is consulted.

Format

The alphabetical listing of all application terms makes the Index quite easy to use. As stated in the instructions (p. D-4), all terms are listed in direct (e.g., Cyclic Chemicals), rather than inverted form (e.g., Chemicals, Cyclic). Although the exclusion of inverted terms results in a shorter Index, a shorter list may well make the Index more difficult to use than a longer list (which would lead the user directly to the correct application term with less searching for the proper term).

Because the multilevel hierarchy of the applications list requires that code numbers of valid application terms be included in the Index, these code numbers will need to be revised when new application terms are added to the applications list.

Content

The failure to show in the Index the valid application terms that are above and below the listed term in the applications list hierarchy is not a significant shortcoming because the multilevel nature of the

applications list might require repetition of a very large number of entries in the Index.

Numerous application terms are defined in the applications list (either in the application title or in parenthetical explanations) as containing applications that are not listed separately as subsets in the applications list hierarchy. These applications are not listed in the Index with a cross reference to the appropriate valid application term (e.g., "Medicinal chemicals" and "Botanicals" are both included in the definition of "05 Drugs and other pharmaceuticals" but neither is listed in the Index so that a cross reference to "05 Drugs and other pharmaceuticals" can be made).

The definitions of many application terms include a statement of what applications are excluded from the definition. Once the user learns that a particular application is specifically excluded from one application term, the user will probably then look in the Index for a listing of the actual words used in the definition to describe the excluded application. Unfortunately, most if not all of these excluded applications do not appear as entries in the Index. Consequently, the user knows where the application should not be classified but is given no guidance on where it should be classified (e.g., "Testing laboratories associated with manufacturing plants" is excluded from the definition of "0401 Commercial testing" but no entry is listed in the Index so that a cross reference to an appropriate classification can be given).

To further clarify how the application term, "16 Miscellaneous products and services," is to be used, Index entries for "Applications not listed," "Other applications," and "Unknown applications," with appropriate cross references to "16 Miscellaneous products and services," should be added.

During the trial run, the following problems with the content of the applications Index were noted:

- There were no entries for the common term, "Polymers," giving a cross reference to "21 Plastic and rubber materials and synthetics (not fabricated)," or for "Mobile homes,"

with a cross reference to "135 Prefabricated wood buildings," or for "Parchment," with a cross reference to "1924 Packaging and industrial converting paper."

- There were no entries for the following common terms with appropriate cross references: "Shellac (except bleached)," "Metal nitriding," "Embalming fluids," "Carpet laying," "Rubber electrical insulation," "Rubber rollers," "Aerosol paints," and "Appliances."
- Because the applications list includes "19115 Pressure sensitive tape" as a subset of "19 Paper and allied products" and includes "2642 Gasket, packing and sealing devices" as a subset of "26 Stone, clay, ceramic, glass and concrete products." any such products not made from these materials could not be classified under these valid application terms. No Index entries directing the user to alternative valid application terms were available so more general terms had to be selected.

Utility

The utility of the current applications Index is severely limited by the absence of: (1) entries for applications contained in the valid application terms or in the parenthetical explanations of these application terms but not listed separately in the various levels of the applications list hierarchy; (2) entries for applications that are described in the applications list as being excluded from specific valid application terms; and (3) entries for applications that cannot be classified in certain valid application terms because the valid term is restricted to products based on a particular material of construction.

Because of the deficiencies of the existing applications list, even if the missing entries just described were added to the existing applications Index, it is very doubtful that the combination of the existing applications list and an improved index would assure that users would be able to classify chemicals into meaningful specific applications in an efficient manner.

IV. EVALUATION OF THE OTS EXPOSURE ESTIMATION METHODOLOGY

Introduction

The EPA-OTS and its contractor, Calculon, have developed an exposure estimation methodology based on the Use List described in Federal Register of July 25, 1978, in which chemical use categories are used as surrogates for exposure data. This methodology requires that three assumptions be met, or that their violation be shown to be unimportant. These assumptions are: (1) chemicals will be correctly assigned to use categories; (2) correct exposure estimates will be assigned to each use category; and (3) exposures actually associated with individual chemicals will be adequately characterized by the exposure estimates assigned to the use categories to which these chemicals belong.

This chapter describes the results of Task 2 and includes discussions of the exposure estimation methodology, the modifications in the methodology, the probabilities of violation of the three assumptions, the probability that these errors will lead to erroneous decisions when applied to either new or old chemicals, and an alternative approach. The assessment of the third and fourth of these five items forms the core of the chapter.

This assessment of the importance of errors assumes that the three assumptions are independent, and hence that their probabilities of error can be multiplied to estimate the probability of error for the methodology as a whole. The independence of the first two assumptions is plausible because the assignments of chemicals to use categories and the computation of exposure estimates for those categories will be performed by different people operating with different data bases. The third assumption depends on the variability in the physical and chemical properties possessed by chemicals that occur in a given use category and hence is influenced more by the manner in which categories are defined

than by anyone's ability to estimate an average exposure for the category of anyone's understanding of the terminology of the Use List.

The Exposure Estimation Methodology

The exposure estimation methodology developed by Calculon contained eight variables grouped into four factors: mode of human exposure, mode of environmental exposure, amount of human exposure, and amount of environmental exposure. This methodology included indices for the number of routes and the number of forms of exposure, but did not distinguish between the contexts, occupational versus consumer, in which these exposures occurred. The methodology also included an implicit mechanism for differentially weighting the eight variables.

The Calculon methodology was subsequently modified by the OTS to the form presented in Table 1. This version omits the two factors in the Calculon version that were concerned with the mode of exposure, but differentiates between occupational and consumer exposures. The OTS version omits the explicit weighting mechanism of the Calculon procedure, but implicitly weights occupational exposures 200 times as heavily as consumer exposures, because the numbers of people associated with comparable index values under occupational and consumer exposures differ by a factor of 200.

The indices for magnitude of contact also differ between occupational and consumer exposure in the OTS methodology. Occupational contacts can be scored from 1 to 3, whereas consumer exposures can be scored from 1 to 4, meaning that heavy consumer exposures are scored more highly than the comparable occupational exposures. Moreover, the magnitudes of contact for both types of exposures are defined in the explanatory notes as percentages of the final product, and consequently require that users of the methodology know the nature of the finished product to ascertain whether a light contact, with a score of 1, means that a person has been in contact with a product containing 1 μ g, 1 mg, or 1 gm of the chemical of concern.

Table 1

OTS MODIFICATION OF FACTORS TO BE USED IN MEASURING THE AMOUNTS OF CONTACT

Factor 1		Factor 2		Factor 3	
Amount of Human Occupational		Amount of Human Consumer		Amount of Environmental	
Contact		Contact		Contact	
A. No. of Persons Exposed		A. No. of Persons Exposed		A. Amount of Discharge	
1. <1,000		1. <200,000		1. As constituent of a bulk solid	
2. 1,000-10,000		2. 200,000-2,000,000		2. Up to 1% of substance	
3. 10,000-100,000		3. 2,000,000-20,000,000		3. 1-10% of substance	
4. >100,000		4. >20,000,000		4. 10-100% of substance	
B. Magnitude of Contact		B. Magnitude of Contact		B. Extent of Geographic Discharge	
1. Trace		1. Trace		1. One location	
2. Light		2. Light		2. Limited	
3. Heavy		3. Moderate		3. Widespread	
		4. Heavy			
C. Duration of Annual Contact (hr/yr)		C. Frequency of Contact			
1. <200		1. Yearly			
2. 200-2,000		2. Monthly			
3. >2,000		3. Weekly			
		4. Daily			

The measures of number of contacts differ between occupational and consumer exposures, both with respect to the manner in which they are expressed and the ranges in the scores that can be assigned to these two variables. Occupational exposures are expressed as the duration of contact in hours per year with a maximum score of 3 whereas the consumer exposures are expressed as the frequency of contacts with a maximum score of 4. The scale for occupational contact begins with a score of 1 for contacts up to five work weeks in duration, and extends to contacts in excess of a normal work year. Although the highest scores for the duration of occupational contacts could only be obtained by extended contact each day, the lowest score could occur in several patterns (e.g., a single period of continual contact or in weekly contacts of approximately four hours duration). Thus, the scale for the occupational contact is generally more ambiguous than the scale for consumer contacts, which specifies either daily, weekly, monthly, or yearly contacts.

The OTS methodology omits indicators of the route of exposure (e.g., respiratory, dermal) or the form of exposure (e.g., solid, liquid), both of which influence the seriousness of exposure. However, it is not clear how one should weight the various forms and routes of exposure and consequently it is not evident that multiple routes of exposure should necessarily be weighted more heavily than single routes of exposure. The alternatives taken by the Calculon methodology that gave each route and form of exposure equal weight and the OTS methodology that ignores these phenomena therefore seem to be of equal value.

The scale for magnitude of environmental contact (amount of discharge) parallels the scale for consumer exposures, both with respect to the reliance on percentage data and the use of a scoring range from 1 to 4. The scale for the number of contacts (extent of geographic discharge) differs from the scales for consumer exposure with respect to the range of possible scores (3 versus 4 points), but is no more ambiguous than the scales for the numbers of people exposed, given the wide range in the numbers of people represented by the scores in the latter scales.

The overall effect of the uneven features of the OTS methodology is to obscure the relative weight given to occupational versus consumer human exposures and to human versus environmental exposures. The use of the percent present in a product as a measure of magnitude of contact without knowledge of the quantity of the product involved prevents measurement of the total magnitude of exposure for different products (i.e., 0.1% present in a product produced in million pound quantities represents more exposure in absolute terms than a level of 10% in a product where the quantity of product is only a few thousand pounds). The net effect is that the methodology is harder to interpret than is necessary.

Modification of Methodology

In view of the above described problems with the OTS methodology, we suggest that the methodology be further modified by:

- Putting numbers of people for occupational and consumer exposures on a common scale
- Putting magnitude of contact on the same numerical scale for both occupational and consumer exposure
- Putting the duration/frequency scales on a single basis
- Making the number of possible scores consistent among the components of exposure
- Making the scales for environmental exposures as nearly equal to the other two as possible.

These changes have been made in the SRI-developed version shown in Table 2; however, occupational and consumer exposure are still weighted more heavily than environmental exposures, because these two classes of exposure can contribute four times more to the overall score than can the environmental exposures. Although we did not reinstate the explicit weighting methodology that had been present in the Calculon version because of significant difficulties in obtaining weights upon which all interested parties can agree, this differential can be easily removed, if desired. Either two more components can be

Table 2
PROPOSED FACTORS TO BE USED IN MEASURING THE AMOUNTS OF CONTACT

<u>Factor 1</u>		<u>Factor 2</u>		<u>Factor 3</u>	
<u>Amount of Human Occupational Contact</u>		<u>Amount of Human Consumer Contact</u>		<u>Amount of Environmental Contact</u>	
A.	No. of Persons Exposed	B.	No. of Persons Exposed	A.	No. of Locations of Discharge
1.	<10 ⁵	1.	<10 ⁵	1.	1-10
2.	10 ⁵ -10 ⁶	2.	10 ⁵ -10 ⁶	2.	10-100
3.	10 ⁶ -10 ⁷	3.	10 ⁶ -10 ⁷	3.	100-1,000
4.	>10 ⁷	4.	>10 ⁷	4.	>1,000
B.	Magnitude of Contact	B.	Magnitude of Contact	B.	Amount of Discharge (Metric Tons)
1.	<10 mg	1.	<10 mg	1.	<1
2.	10-100 mg	2.	10-100 mg	2.	1-10
3.	100 mg-1g	3.	100 mg-1g	3.	10-100
4.	>1g	4.	>1g	4.	>100
C.	Frequency of Contact	C.	Frequency of Contact		
1.	Yearly or less	1.	Yearly or less		
2.	Monthly	2.	Monthly		
3.	Weekly	3.	Weekly		
4.	Daily	4.	Daily		
D.	Duration of Contact	D.	Duration of Contact		
1.	Seconds	1.	Seconds		
2.	Minutes	2.	Minutes		
3.	Hours	3.	Hours		
4.	Days	4.	Days		

added to the environmental factor or the scores for the number of locations of discharge and the amount of discharge can be doubled. We did not add extra scoring components because the phenomena that seemed most important--rapidity of transformation and measures of the ease of transport--both required more data or sophistication of judgment than we felt could be readily provided. We elected not to double the weight given to the two environmental components that were included since it would have meant a further departure from the version developed by the OTS and Calculon without clearly improving or clarifying the scoring methodology.

Because the ranges in magnitude of each of the ten variables included in the modified system differ from adjacent ranges by one order of magnitude, or approximately so, the scoring system is effectively based on logarithms. Hence, adding scores for the ten components to obtain an overall score is equivalent to multiplying the numbers that they represent. Thus, a score of 26 would represent roughly 10^8 more units of exposure than would a score of 18.

Although these very large differences in units of exposure are associated with rather modest differences in overall scores, transforming the scores into linear scales of exposure is not necessary. Indeed, to do so would simply make the awkwardness of the units conspicuous, thereby raising questions that are irrelevant to the establishment of relative measures of exposure. The units of exposure are unconventional due to the merging of environmental exposures with occupational and consumer exposures. The result is a meaningless unit for absolute measures of risk, but this is of no concern when only relative measures are needed. Indeed, for purposes of assessing the relative magnitudes of exposure, it is far more important to keep in mind that the methodology leaves out many nuances which are important when one is attempting to obtain precise estimates of risks. Some of these omissions will surely be sources of error in the screening methodology. For example, if the number of persons exposed is based on exposure to a class of chemicals, the exposures of most individual chemicals in classes containing large

numbers of chemicals will be grossly overestimated. The exposures of chemicals in classes with few members will be less severely overestimated. Similarly, the scoring system will work better for those classes of use that necessarily require a fairly rigid set of physical or chemical properties to satisfy the need of the user than for those classes of use in which various combinations of properties are effective in the particular application. For example, if the chemicals that met a user's needs varied one or more orders of magnitude in volatility, the exposures associated with these chemicals would be poorly represented by any one estimate.

Applications of Methodology to New Chemicals/New Uses

Probability That Estimate Components Are Accurate

To better evaluate the utility of the scoring system for application to new chemicals and new uses of old chemicals, expert opinion was sought on the probability that the individual components would be accurately determined. Three Senior Industrial Economists in the Chemical Industry Economics Program of SRI's Chemical Industries Center and a Senior Industrial Hygienist in the Environmental Group of SRI's Center for Occupational and Environmental Safety and Health were surveyed for this purpose. The derivation of the Use List and the components of the scoring system were explained to them. To solicit their comments on the components of the modified scoring system depicted in Table 2, they were each asked the following four questions in the sequence shown (opportunity was given for further discussion of each aspect of the system before the next question was asked):

- (1) What is the probability of assigning a chemical to the correct use category using the Use List?
- (2) What is the probability of assigning correct exposure estimate scores to the individual use categories if the assignment is made by: (a) an industry expert or (b) a generalist with no experience in the area involving the particular use?
- (3) What is the probability that the exposure situation for a specific new chemical will be accurately reflected by the exposure estimate score of the use category to which it is assigned?

- (4) What are the relative merits of using the exposure estimates for use categories as a measure of exposure to a specific chemical versus obtaining exposure estimates on the specific chemical directly from the manufacturer and/or processor?

A summary of their answers and the subsequent discussions follows.

Question 1. Assigning Chemicals to Use Categories

The consensus was that assigning chemicals to use categories should cause no problem if:

- Combinations of function and application components beyond those given in the July 25, 1978 Federal Register were permissible.
- Additional functions and applications could be added to the lists to further subdivide the categories as needed to properly characterize uses.

The estimates of probability of success ranged from 90 to 100%.

Question 2. Assigning Scores to Use Categories

The estimates of the probabilities of assigning correct scores to use categories varied considerably. The lower estimates appear to have been based largely on disbelief in one premise for assigning scores to a use category--namely, that single values could be assigned for the whole class of chemicals covered by the use category. For example, in a use category containing a total of 30 chemicals, if one or two represented 70-90% of the total quantity used and the number of people exposed to these two (or the magnitude, frequency, or duration of exposure) was dramatically different from the values for the other members, would the scores be estimated to represent all 30 chemicals, only the most significant two, or some combination of these (i.e., what basis would be used to estimate a typical value)?

Not unexpectedly, the estimates of success for assignments by an expert were uniformly much higher than for those by a generalist, but even the estimates for an expert were not very high: from a low of less than 25% to a high of only 85%. The range for a generalist was 1% to

30% with some feeling that a generalist would probably come closer to the expert in the area of consumer exposure than in the occupational exposure area. The opinion was expressed that a higher probability of accurate estimates would be possible for applications that had been subcategorized in sufficient detail to pinpoint a particular use area (i.e., where a single market was identified, not several similar but different markets covered by a more general description).

Question 3. Appropriateness of Use Category Scores for Specific Chemicals

Estimates were sought for each of the four major components of the exposure estimates for occupational and consumer exposure. The four staff members estimated that the probability of the use category estimate components being appropriate for the specific chemical were as follows:

Exposure Type	Number of People Exposed*	Contact		
		Magnitude	Frequency	Duration
Occupational	50,50,50,10	50,<50,30,80	70,>50,>60,90	90,>50,30,90
Consumer	90,50,50,10	40,<50,30,80	50,<50,>60,90	70,<50,30,90

* The probability estimates of individuals are given in a consistent position; for example, one individual was responsible for the first probability estimate in each set of four.

The 10% estimate for the number of people was based on the belief that the applications were not sufficiently subdivided to assure that the typical value for the use category would come close to that of individual chemicals in the use category. The 80% estimate for the magnitude of contact was based on a belief that the relative efficiency of the chemicals in carrying out the function in the particular application would be the major influence on the magnitude of exposure and that changes in efficiency exceeding the 100-fold range represented by each score would be very unlikely. Although the estimates vary somewhat, the

general feeling was that magnitude, frequency, and duration estimates were sufficiently related that the probabilities of appropriateness of the use category estimates for a specific chemical would be about the same for all three of these components.

If the eight probability estimates of each expert are multiplied, and the four resulting products are averaged, the resulting value of the probability of correctly assessing all eight parameters is about 0.006.

Question 4. Relative Merits of Use Category Scores vs. Estimates on Specific Chemicals

There was unanimous agreement that the characterization of a specific chemical by the exposure estimate scores developed for a use category was a very inefficient way to accurately assess the exposure possibilities of a specific new chemical compared to seeking estimates for that chemical. The probability that estimates by manufacturers and/or processors of the number of people, and the magnitude, frequency, and duration of contact would provide more accurate scores for the specific chemical was estimated at greater than 90% for both occupational and consumer exposure.

Significance of Scoring Errors

Despite the preceding estimates of high probability of errors in scoring if the methodology were to be used with new chemicals, the usefulness of the scoring methodology is impaired only if many of the errors cause poor decisions. Because it is anticipated that the 800-1000 chemical use categories will be grouped into 10-15 groups according to the scores assigned by the scoring methodology, and because it is probable that resource constraints will prohibit examination of chemicals assigned to categories outside the group or groups with the highest scores, only those errors that determine the presence or absence of a use category from this top group or top set of groups will affect decisions regarding subsequent actions.

The probability that such an error will occur is most simply appraised by determining the probability that a one-point error in the total score for a chemical use category will occur and will cause an erroneous decision. This probability is itself the product of two probabilities. The first is the probability that a one-point scoring error will cause the chemical use category to be placed in the wrong group. The second is the probability that this will be a move from the group just below the decision threshold to the group just above, or from the group just above to the group just below.

Because the scoring methodology allows a maximum score of 40 and a minimum score of 10, the scores for the 800-1000 use categories will span a range of 30 points. If they are grouped into ten groups, with a spread of 3 points in each group, then an error of one point in scoring would have one chance in three ($p = 0.33$) of causing an error in placement of that chemical use category. Two points of error in the same direction would have two chances in three of causing an error ($p = 0.66$), and three in the same direction would ensure it. Multiple errors in varying directions would either act as unidirectional errors or simply not affect the score, depending on the extent to which errors in opposing directions are balanced.

If we assume, for the moment, that only one-point errors occur and that the 800-1000 use categories are evenly distributed among the ten groups, then only 1/9 or 11% of the errors in assigning use categories to the ten groups of use categories will move a chemical use category from one side of the decision threshold to the other. Thus, under these simplifying assumptions, the probability that a one-point error in scoring of use categories will cause a poor decision is 0.33 (the probability of a shift from one group of use categories to another) $\times$ 0.11 (the probability that the shift from one group to another will affect a decision) or 0.04.

The probability that a one-point error in scoring will occur can be computed in a similar manner. Given that the scoring methodology requires the input of ten numbers, if the probability of a correct

assessment for each is 0.9, the probability that all ten will be correct is 0.9^{10} or 0.35. Hence, the probability of an error is 0.65, if this relatively optimistic assumption is used. If the probability of estimating each of the ten numbers is assumed to be 0.5, then the probability of all being correct is 0.5^{10} or 0.001, and the corresponding probability of error is 0.99. Hence, these assumptions, which bracket the expert's estimates, suggest that the probability of error lies between 0.65 and 0.99.

The significance of these high probabilities of error diminishes greatly, however, when these estimates of the probability of an error in scoring are combined with the relatively low probability that an error will affect decisions. Thus, under the assumptions used, the probability that a poor decision will be made due to an error in scoring and grouping use categories will lie between 0.03 and 0.04 (i.e., 0.04×0.65 and 0.04×0.99) if only those uses falling within the highest scoring groups or perhaps the higher two to three groups are retained for further study. This may also be stated as being a probability of 0.96 to 0.97 that the decision will be correct.

The implications of the six assumptions used in the preceding four paragraphs are discussed in Appendix F.

Accuracy of Methodology

The net effect of the preceding analysis is to rule out, as serious problems, the first two assumptions set forth in the Introduction of this chapter. Thus, the utility of the scoring methodology stands or falls upon the probability that the scores assigned to categories of chemical use will be reliable indicators of the exposures associated with individual chemicals within those categories. Using the expert opinion described above as an approximation, the probability that high exposure chemicals will be identified by the scoring methodology can be optimistically set at 0.99 (the experts gave 0.9-1.0 as the probability that a chemical will be assigned to the correct use category) $\times$ 0.97 (the probability, computed above, that the use category will be correctly

placed with respect to the decision threshold) $\times <0.1$ (the average of products of the eight estimates, given by each expert, of the probabilities of correctly scoring individual components of exposure) or <0.1 . Even if the experts were unduly pessimistic and each of the eight probabilities given in response to the third of the four questions which they were asked was actually 0.7, the probability of a correct decision would still be only 0.06, or one in sixteen. Thus, even an optimistic estimate of the accuracy of the overall performance of the scoring methodology implies that assessments of the exposures associated with the individual chemicals will be wrong about 15 out of 16 times, with the failure of scores for the use categories to accurately reflect the exposure associated with individual chemicals being the decisive factor.

Application of Methodology to Old Chemicals/Old Uses

The arguments regarding the inaccuracies of the scoring methodology when applied to new chemicals/new uses apply equally well to old chemicals/old uses. However, for old uses of old chemicals, where the EPA lacks the authority to require submittal of data, and yet must cope with an estimated 40,000 chemicals, the inaccuracies of the scoring methodology do not necessarily destroy all utility of this system. It might be useful if it could be shown to be sufficiently accurate to separate out some subset of chemicals that unquestionably have higher than average exposures. This would be true even though the ability of the scoring methodology to reliably discriminate among the chemicals within this high exposure subset seems highly questionable given the arguments presented in the preceding section on new chemicals/new uses.

Two arguments can be made in support of the ability of the methodology to usefully narrow the estimated 40,000 chemicals to a more manageable number. First, if we use a rough approximation of the estimates of the SRI experts that the probabilities that the scores for chemical classes for the ten components of exposure will correctly reflect the scores that individual chemicals should receive, and assume that the probabilities of any one of the ten factors correctly representing the exposure for individual chemicals is 0.5, then we can expect the

probability of misrepresenting all ten factors to be equal to the probability of correctly representing all ten factors. The probabilities of either correctly or incorrectly representing all ten would then be 0.5^{10} or less than 0.01. Hence, ignoring multiple point scoring errors, there would be less than one chance in one hundred that the difference of 10 points will exist between the score a chemical should receive and the score assigned to it by virtue of its use category's score. Thus, if one retains for further study chemicals with a score of more than 30, we can expect to retain: (1) those chemicals that correspond closely to the scores assigned to the use categories to which they belong, when those use categories are scored between 31 and 40; (2) virtually all of those chemicals that are misscored but actually warrant a score of 40 (i.e., those uses for which all components would have to be misscored or for which a few would have to be very poorly scored, to reduce the score to 30); and (3) a significant fraction of those chemicals that have high but not the highest exposures, for example those with exposures corresponding to scores of 37-39 (i.e., those chemicals for which 8 or 9 points of error are needed to exclude them from further study). Thus, the chemicals with the highest exposures will probably fall within the score range from 31 to 40 and be retained.

Secondly, given the tendency for distributions of large numbers of items to be either normal or log-normal (rather than uniform as assumed in the analyses in prior sections), it is probable that the potential for separating a relatively small number of high exposure chemicals from the larger number of moderate and low exposure chemicals is high--much higher than under the assumption of a uniform distribution. With either a normal or log-normal distribution, a user of the scoring methodology could examine only the upper tail of the distribution (e.g., the top 10% of the chemicals at the most and probably only a few hundred chemicals) without missing many high exposure chemicals. These probabilities and the resultant decisions on how many chemicals should be retained can be determined once the distribution of the appropriate categories scores for the 40,000 chemicals is known.

Because each point in this scoring system corresponds to roughly an order of magnitude variation in one component of exposure, the 9-point spread (scores of 31-40) would correspond to about 9 orders of magnitude variation in the actual units of exposure, if one gives equal weight to variations in the numbers of people exposed, the duration of exposure, the frequency of exposure, and the amount of contact per exposure (as in the proposed methodology shown in Table 2). The highest exposures among those retained (scores close to 40) would be much higher than the exposures for those excluded from further study. Thus, the methodology, when combined with toxicity information, can be expected to capture most if not all chemicals characterized by exceptionally high exposures and exceptionally high potential for damage per unit of exposure. However, given the experts' lack of confidence in the estimates of the scoring elements, it is probable that the methodology would be of little use in ranking chemicals within the set of the chemicals with the highest exposure.

It is also probable that the methodology would perform very poorly for less hazardous chemicals characterized by the combination of moderate exposure and high potential for damage per unit of exposure; intermediate scores can be obtained in numerous ways as a result of partially compensating errors.

If a decision were made to investigate further only those chemicals in the highest of the ten scoring groups (i.e., those with scores of 38, 39, or 40), then the cost of using the scoring methodology on all 40,000 chemicals could be reduced by proceeding in a stepwise fashion to eliminate categories from further scoring if their scores for a few selected subfactors indicated that their total scores could not be in the 38-40 range. For example, the number of persons exposed occupationally could be determined first. The possible scores for this subfactor range from 1-4, so that any use categories found to have a score of 1 (categories where less than 100,000 persons are exposed occupationally) could be dropped from further consideration, because the total score could no longer amount to 38, 39, or 40. The categories found to have scores of 2-4 for the number of persons exposed occupationally could then be scored

for the number of persons exposed in consumer contacts. Only those categories having a total score of 6-8 (out of the possible combined score of 8 for persons exposed from both occupational and consumer contact) would be retained for further scoring. By continuing this process through the remainder of the subfactors, the number of categories of continued interest could be systematically reduced until some preferred number was reached. At that point, scoring of all remaining categories for all remaining subfactors might be appropriate.

APPENDIX A

CHARACTERIZATION OF INDUSTRY COMMENTS BY TYPE OF RESPONSE

CHARACTERIZATION OF INDUSTRY RESPONSES BY TYPE OF COMMENT

<u>Type of Industry Comment</u>	<u>EPA Response Number</u>
1. Purpose of list	34, 48, 49, 52, 53, 54, 58, 61, 64, 68, 71, 79, 82, 83, 89
2. List is usable	25, 28, 37, 62, 72
3. Abandon the system	11
4. Not useful for EPA objectives	11, 16, 19, 47, 65, 79, 82, 89, 94, 95
5. Burden to report	11, 22, 32, 50, 58, 83
6. Use should be defined by end users	3, 11, 12, 15, 22, 47, 48, 49, 51, 55, 61, 65, 76, 79, 82, 83, 85, 86
7. Confusing for persons of moderate technical background	7, 10, 19, 30, 34, 38, 40, 47, 48, 51, 53, 68, 73, 74, 78, 79, 82, 83, 85, 89, 95
8. Ambiguity of functions and applica- tions	34, 47, 48, 49, 50, 51, 52, 53, 65, 67, 68, 78, 79, 82, 89
9. Separate lists of functions and applications	56, 65, 73, 82, 84, 89, 91

10. Report in industry's own words	19, 47, 49, 52, 58, 79, 91
11. Application to SNUR	3, 47, 48, 49, 50, 52, 61, 71, 86
12. Simplify instructions	14, 15, 84
13. Redefine function and application	2, 21, 52, 63, 82
14. Broaden categories of use	16, 48, 70, 84
15. Include an "unknown" category	12
16. Include a "starting material" category	61
17. Use alphabetical system	21
18. Do not use alphabetical arrangement	63
19. Base applications on entire SIC code	73
20. Correlate both functions and applications with SIC code	37
21. Reverse format of Appendix I	52
22. Reorganize Appendix I with major classes	70
23. Expand codes	7
24. Less detail in applications	34
25. List should be more comprehensive	26
26. Different sources	22, 82
27. Alternative approaches	46, 36, 11, 34, 64

APPENDIX B

CLASSIFICATION OF USES OF FIVE SELECTED CHEMICALS

CHEMICAL: AMMONIA

SOURCE: Chemical Economics Handbook, SRI International
USE AS NORMALLY DESCRIBED IN THE INDUSTRY

PAGE		Function		Application	
		Code	Name	Code	Name
756.1006	B	129	Production of nitric acid	020	Industrial inorganic chemical
	B	129	Production of acrylonitrile	0210	Acyclic chemical
	C	129	Production of urea	0210	"
	C	129	Production of ammonium sulfate	020	Industrial inorganic chemical
	C	129	Production of ammonium nitrate	020	"
	I	129	Production of caprolactam	0211	Cyclic chemical
	J	129	Production of hexamethylenediamine (in mfr. of nylon 6/6 fibers & plastics)	0210	Acyclic chemical
	M	129	Nitrogen fertilizer (i.e., direct application of anhydrous & aqua ammonia)	012	Crop production
	Y	136	Dilute solutions for household cleaning uses	2512	Specialty cleaner
	Y	136	Ingredient of household cleanser formulations	2512	Specialty cleaners
	X	129	Extraction of vanadium from its ores	1528	Uranium-radium-vanadium ore mining
	X	129	Extraction of tungsten from its ores	1527	Misc. metal ore mining
	X	129	Extraction of molybdenum from its ores	1527	"
	X-Y	129	Used in metallurgical market to provide a reducing atmosphere or source of nitrogen (by dissociation) for nitriding or carbonitriding	064	Metal processing operations
	Y	129	Modifying reagent in the froth flotation of phosphate ores	15302	Phosphate rock mining
	Y	2632	Refrigerant in industrial refrigeration facilities	1484	Refrigeration, air conditioning & heating equipment
	Y	3080	Nutrient in secondary wastewater treatment ponds	04320	Industrial water treatment systems
	Y	384	Solvent for casein in pigmented coatings for pulp & paper industry	1911	Coated & glazed paper products
	Y	129	Used in sulfite or semichemical pulping processes for pulp & paper industry	195	Pulp mill products

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CHEMICAL: AMMONIA - continued

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
PAGE		Function		Application	
		Code	Name	Code	Name
Z	Reduces taste & color of chlorine in purified water supplies	129	Chemical raw material	04070	Water purification (industrial)
		129	Chemical raw material	04071	Water purification (municipal)
Z	Used for sludge digestion control in sewage treatment	129	Chemical raw material	04321	Sewage treatment systems
Z	For pH adjustment, in secondary wastewater treatment ponds for various industries	329	pH control agent	04320	Industrial water treatment systems
Z	Processing of uranium ores to produce uranium concentrate	129	Chemical raw material	1528	Uranium-radium-vanadium ore mining
611.5030 A	Production of lower alkyl (C ₁ -C ₄) amines	129	Chemical raw material	0210	Acyclic chemicals
642.5030 B	Production of ethanolamines (mono, di, and tri)	129	Chemical raw material	0210	"
	Production of ethylene amines (ethylene diamine, diethylene triamine, etc.)	129	Chemical raw material	0210	"
	Production of hexamethylene tetramine	129	Chemical raw material	0211	Cyclic chemicals
	Production of fatty nitriles and amines	129	Chemical raw material	0210	Acyclic chemicals
760.5001 A-D	Production of monoammonium phosphate	129	Chemical raw material	020	Industrial inorganic chemicals
	Production of diammonium phosphates	129	Chemical raw material	020	"
733.6000 B	Production of sodium carbonate	129	Chemical raw material	020	"
756.1000 D	Leaching agent in copper ore processing	129	Chemical raw material	1521	Copper ore mining
D	Solvent for sulfur in ammonia-sulfur fertilizer solutions	384	Solvent	012	Crop production
535.8001 C	pH control in urea-formaldehyde solutions to prevent polymerization during storage and shipping	328	pH control agent	0210	Acyclic chemicals

CHEMICAL: ETHYL ACETATE

SOURCE: Chemical Economics Handbook, SRI International; Publisher Product Catalog, p. 87 (1971)
USE AS NORMALLY DESCRIBED IN THE INDUSTRY USE AS DESCRIBED USING EPA DESCRIPTORS

PAGE		Function		Application	
		Code	Name	Code	Name
PPC	Solvent for nitrocellulose	384	Solvent	2131	Thermoplastic resins & plastics
"	Solvent for ethyl cellulose	384	Solvent	2131	"
"	Solvent for cellulose acetate	384	Solvent	2131	"
CEH, p. 643.	Solvent for Snellac	384	Solvent	1880	Bleached shellacs
5030C	Solvent for plastics (e.g., synthetic rubber and vinyl resins)	384	Solvent	2131	Thermoplastic resins & plastics
"	Solvent for ink	384	Solvent	214	Synthetic rubber
PPC	Raw material for manufacture of ethyl acetoacetate	129	Chemical raw material	0210	Acyclic chemical
"	Solvent for purification of ethyl acetoacetate and medicines	384	Solvent	05	Drugs & other pharmaceuticals
"	Solvent in manufacture of candy glaze	384	Solvent	0983	Confectionery products
"	Solvent in manufacture of cleaning compounds & fluids	384	Solvent	04120	Dry cleaning
"	Solvent in manufacture of embalming fluids	384	Solvent	16	Misc. Products & Services
"	Solvent in manufacture of flavors	384	Solvent	0911	Flavoring extracts
"	Solvent in manufacture of nail polish remover	384	Solvent	2504	Manicuring preparations
"	Solvent in manufacture of paint & varnish removers	384	Solvent	1861	Paint & varnish removers
"	Solvent in manufacture of perfumes	384	Solvent	2505	Perfume, cologne, & toilet water
"	Solvent in manufacture of spirit varnishes	384	Solvent	1809	Varnishes (exterior)
"	Denaturant for denatured alcohol (29, 35, 35A)	113	Denaturant	1832	Varnishes (interior)
				F384	Solvents

CHEMICAL: ETHYLENE

SOURCE: Chemical Economics Handbook, SRI International

USE AS NORMALLY DESCRIBED IN THE INDUSTRY USE AS DESCRIBED USING EPA DESCRIPTORS

PAGE	Function	Application	
		Code	Name
CEH, p. 648. 5053P	Production of low density polyethylene	1290	Monomer
Q	Production of high density polyethylene	1290	Monomer
R	Production of ethylene oxide	129	Chemical raw material
5054M	Production of ethylbenzene (all of which is used to make styrene)	129	Chemical raw material
P	Production of alpha-olefins	129	Chemical raw material
P	Production of aliphatic alcohols	129	Chemical raw material
V	Production of ethyl alcohol	129	Chemical raw material
X	Production of acetaldehyde	129	Chemical raw material
5055A	Production of vinyl acetate	129	Chemical raw material
A	Comonomer in ethylene-vinyl acetate resins & emulsions (contain <60% vinyl acetate)	1290	Monomer
B	Production of ethyl chloride	129	Chemical raw material
E	Production of ethylene-propylene elastomers	1290	Monomer
G	Production of propionaldehyde	129	Chemical raw material
H	Production of ethylene dibromide	129	Chemical raw material
I	Comonomer for modified polypropylene (having improved impact resistance for use in injection molding and wire & cable applications, as well as film)	1290	Monomer
J	Comonomer in vinyl acetate adhesives which contain > 60% vinyl acetate	1290	Monomer
J	Production of vinyl toluene	129	Chemical raw material
J	Production of triethylaluminum	129	Chemical raw material
J	Production of ethylaluminum chlorides	129	Chemical raw material
K	Production of ethylamines	129	Chemical raw material
K	Production of diethyl sulfate	129	Chemical raw material
K	Production of 1,4-hexadiene	261	Growth regulator
K	Ripening agent for fruits & vegetables	261	Growth regulator
K	Production of ethyl bromide	129	Chemical raw material
5053Z	Production of ethylene dichloride	129	Chemical raw material

CHEMICAL: UREA

SOURCE: Chemical Economics Handbook, SRI International

USE AS NORMALLY DESCRIBED IN THE INDUSTRY USE AS DESCRIBED USING EPA DESCRIPTORS

PAGE		Function		Application	
		Code	Name	Code	Name
756.2004 H J Q Q R Z	Direct application nitrogen fertilizers	227	Fertilizer	012	Crop production
	Bulk blended nitrogen fertilizer	227	Fertilizer	012	"
	Fertilizer for closed stands of conifers in forest fertilization	227	Fertilizer	0140	Forest nurseries
	Production of ureaforms (slow release nitrogen fertilizers)	129	Chemical raw material	0210	Acyclic chemicals
	Non-protein nitrogen source in cattle feeds	3081	Foodstuffs	0151	Livestock production
756.2005 C E E-F F K K K K K K K	Used for urea-formaldehyde adhesive resins	129	Chemical raw material	2132	Thermosetting resins & plastics
	Used for urea-formaldehyde paper treating & coating resins	129	Chemical raw material	2132	"
	Used for urea-formaldehyde textile treating resins	129	Chemical raw material	2132	"
	Used for urea-formaldehyde surface coating resins	129	Chemical raw material	2132	"
	Production of melamine	129	Chemical raw material	0211	Cyclic chemicals
	In urea mixtures as chemical delcing agents on airport runways	168	Deicer	2881	Transportation terminals
	Production of cyanuric acid	129	Chemical raw material	0211	Cyclic chemicals
	Production of urea hydrogen peroxide	129	Chemical raw material	0210	Acyclic chemicals
	Production of barbituric acid	129	Chemical raw material	0211	Cyclic chemicals
	Manufacture of sulfamic acid	129	Chemical raw material	020	Industrial inorganic chemicals
	Manufacture of ammonium sulfamate	129	Chemical raw material	020	"
760.5001 E 535.8001 B	Production of urea-ammonium phosphates	227	Fertilizer	012	Crop production
	Production of isobutylidene diurea	129	Chemical raw material	0210	Acyclic chemicals

CHEMICAL: SULFURIC ACID

SOURCE: Chemical Economics Handbook, SRI International

USE AS DESCRIBED USING EPA DESCRIPTORS

USE AS NORMALLY DESCRIBED IN THE INDUSTRY

PAGE	Function		Application	
	Code	Name	Code	Name
CEH, P. 780	129	Chemical raw material	0210	Acyclic chemicals
1005 F	129	Production of isopropyl alcohol	0210	"
F	129	Production of sec. butyl alcohol	020	Industrial inorganic chemicals
I	129	Production of aluminum sulfate	020	"
J	129	Production of ammonium sulfate	14651	SLI-type storage batteries
L	207	Electrolyte in lead-acid storage batteries	2101	Rayon, viscose & cupra ammonium processing
M	129	Conversion of viscose into rayon	2101	"
M	129	Conversion of viscose into cellophane	2100	Acetate fibers
M	120	Catalyst in production of cellulose acetate	2101	Thermoplastic resins & plastics
N	129	Production of sodium dichromate	020	Industrial inorganic chemical
N	129	Production of chromic acid	020	"
O	129	Leaching copper from oxide ores in deposits, mine dumps & wastes	0521	Copper ore mining
O	129	Condensing agent in manufacture of DDT	0211	Cyclic chemicals
O	167	Dehydrating agent in manufacture of chloral	0210	Acyclic chemicals
P	129	Processing of phosphate rock to wet process phosphoric acid & normal superphosphate	020	Industrial inorganic chemicals
R	129	Production of hydrochloric acid	020	"
R	129	Production of hydrochloric acid from potassium chloride	020	"
R	129	Production of sodium sulfate	020	"
S	129	Production of hydrofluoric acid	020	"
T	330	Pickling (usually batch pickling) of iron & steel	0645	Surface cleaning & conditioning
U	120	Alkylation of olefins & alkanes in petroleum refining	201	Petroleum cracking & other catalytic processes
U	129	Tube oil refining	203	Catalytic treatment

CHEMICAL: SULFURIC ACID - continued

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
PAGE		Function		Application	
		Code	Name	Code	Name
1005	V	129	Production of phenol via the benzene sulfonation process	0211	Cyclic chemicals
	V	129	Production of copper sulfate	020	Industrial inorganic chemicals
	V	129	Production of nickel sulfate	020	"
	V	129	Production of zinc sulfate	020	"
	Y	129	Production of benzenoid & non-benzenoid synthetic surfactants	0211	Cyclic chemicals
	Y	129	Production of titanium dioxide	0210	Acyclic chemicals
	Z	129	Leaching uranium from ores	020	Industrial inorganic chemicals
		129		1528	Uranium-radium-vanadium ore mining
1006	A	129	Production of citric acid	0210	Acyclic chemicals
	A	129	Production of furfural	0211	Cyclic chemicals
	A	129	Production of hydroquinones	0211	Cyclic chemicals
	A	129	Production of oxalic acid	0210	Acyclic chemicals
	A	129	Production of miscellaneous pigments	F1411	Pigments
	A	129	Production of resorcinol	0211	Cyclic chemicals
	A	129	Production of explosives (e.g., mannitol hexanitrate)		
	A	129	Production of boric acid & oxide	0210	Acyclic chemicals
		129		020	Industrial inorganic chemicals
	A	129	Production of medicinals (e.g., dichloroprene, sulfanilic acid)	05	Drugs and other pharmaceuticals
	A	167	Dry chlorine	020	Industrial inorganic chemicals
	A	129	Coke-oven light oil refining	020	Industrial inorganic chemicals
		129		0210	Acyclic chemicals
	A	129	Fat splitting	0211	Cyclic chemicals
	A	129	Processing parchment paper	0210	Acyclic chemicals
		129		1924	Packaging & industrial converting paper
	A	3933	Phosphate rock flotation	15302	Phosphate rock mining
	A	129	Kraft & ground wood pulping	195	Pulp mill products

CHEMICAL: SULFURIC ACID - continued

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTIONS			
PAGE		Function		Application	
		Code	Name	Code	Name
1006 A A	SBR elastomer coagulation	129	Chemical raw material	214	Synthetic rubber
	Solvent for vat dyes	129	Chemical raw material	2702	Plain, dyed, and finished fibers, yarns, and fabrics
A	Tall oil recovery & deodorizing	129	Chemical raw material	0210	Acyclic chemicals
A	Treatment of sodic soils	380	Chemical raw material	0211	Cyclic chemicals
A	Water treatment (pH control)	328	pH control agent	012	Crop production
				0407	Water supply treatment

APPENDIX C

CLASSIFICATION OF FUNCTIONS AND APPLICATIONS
OF CHEMICALS IN SELECTED PRODUCT TYPES

PRODUCT TYPE: Industrial Adhesives
SOURCES: Skeist Laboratories, Inc.; Adhesive & Sealants II, 1972; Adhesives Red Book, 1978, Palmerton Publishing Co., Inc., N.Y.

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS *		
SOURCE	FUNCTION	APPLICATION	Function Code	Application Name Code
Red Book '78 SRI Staff Skeist	Fillers (Extenders)	Furniture adhesives 1. Vinyl film laminating A. Epoxy type B. Neoprene cement type 2. Plastic laminating A. Neoprene cement type B. EVA hot melt type C. Urea-formaldehyde type 3. Wood & vinyl veneering A. Urea-formaldehyde type B. EVA hot melt type 4. Assembly A. Urea-formaldehyde type 5. Edge-gluing A. Urea-formaldehyde type Footwear adhesives 1. Aftermarket repair A. Neoprene cement type 2. Manufacture A. Natural rubber latex 1) Canvas 2) Box toe 3) Sock, heel pad 4) Counter 5) Doubling & combining 6) Soft sole 7) Heel cover	{ 223 229	1032 Wood partitions & fixtures 100 Household furniture
				0444 Shoe & leather repair work
				0214 Rubber & plastic footwear
				1212 Leather footwear

*When EPA application is listed more than once on page, only code is repeated.

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PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS		
SOURCE	FUNCTION	APPLICATION	Code	Function Name
Red Book '78 Skeist SRI Staff	Fillers (Extenders)	B. Neoprene cement 1) Sole attaching	1212	Leather footwear
		Bookbinding adhesives 1. Edition books A. PVAc type B. EVA hot melt type C. Animal glue type	2301	Bookbinding
		2. Magazines A. Animal glue type B. EVA hot melt type	2301	
		3. Directories A. Animal glue type B. EVA hot melt type	2301	
		4. Catalogs A. Animal glue type B. EVA hot melt type	2301	
		5. Stationery A. Animal glue type B. EVA hot melt type C. PVAc type	1913	Envelopes & stationery products
		6. Softcover books A. EVA hot melt type	2301	
		Automobile adhesives 1. Original equipment A. Nitrile based type B. Neoprene cement type C. SBR cement type D. PVC plastisol	283	Motor vehicles & equipment

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS		
SOURCE	FUNCTION	APPLICATION	Function	Application
			Code	Name
Red Book '78 Skelist SRI Staff	Fillers (Extenders)	2. Aftermarket A. Polyester type B. Nitrile based type	2880	Transportation equip- ment services & repair facilities
		Textile adhesives		
		1. Carpeting A. EVA hot melt B. Vinyl acetate ethylene type C. PVC plastisol D. SB/SBR latex type E. Nitrile latex type	271	Floor coverings
		2. Coatings A. PVC latex type B. PVAc type C. Acrylic type D. Neoprene latex type E. SBR latex type F. PVC plastisol	2730	Coated fabrics, except rubberized
		3. Nonwovens A. EVA hot melt	2736	Nonwoven fabrics & products
		4. Fiberfill, wadding A. PVC plastisol	2737	Padding & upholstery filling
		Wood adhesives 1. Exterior softwood plywood A. Phenolic resin type	132	Millwork, plywood & structural members
		2. Exterior softwood plywood A. Phenolic resin type	132	
		3. Particleboard A. Urea-formaldehyde type	134	Particleboard

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Code	Function	Application
Red Book '78 Skeist SRI Staff	Fillers (Extenders)				
		4. Hardwood plywood A. Urea-formaldehyde type	132		Millwork, plywood, & structural members
		5. Lumber laminating A. Resorcinol-formaldehyde type B. Casein type	132		
		Electrical adhesives 1. TV picture tubes A. Epoxy type	1430		Cathode ray tele- vision picture tubes
		2. Refrigerators & freezers A. SBR cement	1484		Refrigeration, air conditioning, & heating appliances
		3. Air conditioners A. Neoprene cement	1484		
		4. Dishwashers A. Neoprene cement	1481		Household electrical & electronic appli- ances
		Aircraft & aerospace adhesives 1. Structural films A. Nitrile/phenolic type	280		Aircraft & parts
		Friction materials adhesives 1. General binders A. Phenolic resin type	28		Transportation equipment & faci- lities
		Foundry binders 1. CO ₂ gas process A. Silicate based	212		Iron & steel foundry products
		2. Conventional A. Oleoresinous type	224		Nonferrous foundry products

PRODUCT TYPE: Industrial Adhesives

SOURCE	FUNCTION	APPLICATION	USE AS NORMALLY DESCRIBED IN THE INDUSTRY			USE AS DESCRIBED USING EPA DESCRIPTORS		
			Code	Function	Name	Code	Application	Name
		Construction adhesives						
		1. Glued floors						
		A. SB/SBR cement				03201		Floor laying, scraping & finishing
		B. Neoprene cement						
		2. Panels & partitions				103		Partitions & fixtures
		A. Neoprene cement						
		B. PVAc type						
		3. Gypsum wallboard				03231		Plastering, drywall, acoustical & insulation work
		A. PVAc type						
		B. Reclaim rubber cement						
		C. Natural rubber latex						
		4. Glass fiber insulation				03231		
		A. Neoprene cement						
		5. Vinyl film lamination				{ 2602		Gypsum products
		A. PVAc type				{ 1032		Wood partitions & fixtures
		6. Ceramic tile				03232		Terrazzo, tile, marble, & mosaic work
		A. SB/SBR latex						
		B. Reclaim rubber cement						
		7. Resilient flooring				03201		Floor laying, scraping & finishing
		8. Carpet installation				16		Miscellaneous - carpet laying
		A. SBR latex						
		B. Neoprene latex						
		9. Concrete binders				260		Concrete gypsum & plaster products
		A. Epoxy type						

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS		
SOURCE	FUNCTION	APPLICATION	Code	Function Name Application Name
Red Book '78 Skeist SRI Staff	Fillers (Extenders)	10. Wood doors A. Urea-formaldehyde type	1032	Wood partition & fixtures
		Packaging adhesives 1. Paper tubes A. Animal glue B. PV alcohol type C. PVAc type	1914	Pressed & molded pulp goods
		2. Composite cans A. Dextrin type B. Animal glue C. PVAc type D. Neoprene latex	193	Paperboard containers & boxes
		3. Envelopes A. Dextrin type B. Starch type C. PVAc type	1913	Envelopes & stationery products
		4. Gummed tapes & labels A. Animal glue B. PVAc type	19112	Gummed products
		5. Fiber drums A. PV alcohol type	193	
		6. Fiberboard A. PVAc type B. Starch type	1941	
		7. Corrugated board A. Starch type	1941	

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY			USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Function		Application	
			Code	Name	Code	Name
Red Book '78 Skeist SRI Staff		8. Carton sealing A. Polyethylene/polypropylene hot melt			193	Paperboard contain-ers & boxes
		9. Folding cartons A. Polyethylene/polypropylene hot melt B. EVA hot melt C. PVAc type			193	
		10. Bottle labeling A. PVAc type			39	Food & kindred products
					05	Drugs & other pharma-ceuticals
					250	Cosmetics & toilet preparations
		11. Specialty bags A. EVA hot melt B. PVAc type C. Starch type			1910	Bags, except textile bags
					0651	Metal foil & leaf
					0706	Plastic packaging & shipping containers
		12. Multi-wall bags A. Polyethylene/polypropylene hot melt B. EVA hot melt C. Starch type			1910	
					0706	
		13. Grocery bags A. Starch type			1910	
		14. Binderboard A. Starch type			193	Envelopes & station-ery products
					1913	Bookbinding & re-lated operations
		15. Parry liners A. Starch type			230	
					193	
			230			

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTIONS			
SOURCE	FUNCTION	APPLICATION	Function		Application
			Code	Name	
Red Book '78 Skeist SRI Staff		16. Paper cups & tubs A. PVAc type	1914	Pressed & molded pulp goods	
		17. Capliner A. PVAc type	1912	Die cut paper & board products	
		18. Glassine A. PVAc type	19114	Oiled, waxed & wax laminated paper	
		19. Aluminum foil A. PVAc type B. Neoprene latex	0651	Metal foil & leaf	
		20. Metal can sealing A. SBR type	0021	Metal cans	
		21. Government postage stamps A. Dextrin based	19112	Gummed products	
		Pressure-sensitive adhesives 1. PTFE, high temperature A. Silicone type	0709	Unsupported plastic film, sheet, rod & tube	
		2. Reinforced impregnated	19115	Pressure sensitive tape	
		3. Foil A. Natural rubber	0651		
		4. Double-faced A. Natural rubber	19115		
		5. Felt and cork	{ 2732	Felt goods	
		6. Surgical	{ 130	Cork	
		7. Roll label	112	Medical & dental instruments & supplies	
			19115		

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION		Function	
		Code	Name	Code	Application Name
Red Book '78 Skeist SRI Staff	Fillers (Extenders)		8. Sheet stock	19115	Pressure sensitive tape
			9. Floor tile	163	Hard surface floor, wall & counter coverings
			10. Paper	19115	
			11. Cellophane	0708	Regenerated cellulosic products, except rayon
			12. Vinyl	0709	Unsupported plastic film, sheet, rod & tube
			13. Polyester	0709	

PRODUCT TYPE: INDUSTRIAL ADHESIVES
SOURCE: Skeist Laboratories, Inc., Adhesives & Sealants II, 1972

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS *				
SOURCE	FUNCTION	APPLICATION	Function		Application	
			Code	Name	Code	Name
Skeist SRI Staff	Plasticizer	Packaging & labeling adhesives --	333	Plasticizers	1914	Pressed & molded pulp goods
		1. Paper cups & tubs				
		A. PVAc type				
		2. Envelopes				
		A. PVAc type				
		3. Composite cans				
		A. PVAc type				
		B. EVA hot melts				
		4. Bottle labeling				
		A. PVAc type				
B. EVA hot melts						
5. Can labeling						
A. PVAc type						
6. Case & carton sealing						
A. PVAc types						
B. EVA hot melts						
7. Folding cartons						
A. PVAc type						
B. SBR latex type						
8. Specialty bags						
A. PVAc type						
B. SBR latex type						
9. Multi-wall bags						
A. SBR latex type						
*When EPA application is listed more than once on a page, only one code is repeated						

*When EPA application is listed more than once on a page, only code is repeated.

PRODUCT TYPE: INDUSTRIAL ADHESIVES

SOURCE: Skeist Laboratories, Inc., Adhesives & Sealants II, 1972

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTIONS			
SOURCE	FUNCTION	APPLICATION	Code	Function	Code
Skeist SRI Staff	Plasticizer	10. Gummed tapes & labels A. PVAc type			19112 Gummed products
		11. Capliners A. PVAc type			1912 Die cut paper & board products
		12. Glassine A. PVAc type			19114 Oiled, waxed & wax laminated paper
		14. Paper tubes A. PV alcohol type			1914 Pressed & molded pulp goods
		15. Fiber drums A. PV alcohol type			193 Paperboard containers & boxes
		Construction adhesives --			
		1. Concrete binders (cement additives for interior & exterior joints) A. PVAc type B. SBR latex type C. Acrylic type			260 Concrete, gypsum & plaster products
		2. Vinyl film lamination (e.g., wallboard made by continuous lamination of vinyl wall coverings & gypsum board) A. PVAc type			2602 Gypsum products 1032 Wood partitions & fixtures
		3. Smoothing of gypsum wallboard tape joints A. PVAc type			0321 Plastering, drywall, acoustical & insulation work
		4. Gypsum wallboard A. Neoprene latex type			0321
		5. Spackling paste A. PVAc type			0321

PRODUCT TYPE: INDUSTRIAL ADHESIVES
SOURCE: Skeist Laboratories, Inc., Adhesives & Sealants II, 1972

USE AS NORMALLY DESCRIBED IN THE INDUSTRY			USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Function		Application	
			Code	Name	Code	Name
Skeist SRI Staff	Plasticizer	6. Wooden floors A. PVAc type			1032	Wood partitions & fixtures
		7. Panels & partitions A. PVAc type B. Neoprene latex type			103	Partitions & fixtures
		8. Mobile home & recreational vehicle component construction A. PVAc type			282	Miscellaneous transportation equipment
				135	Prefabricated wood buildings	
579.5022 Y Skeist SRI Staff		Textile adhesives -- 1. Textile coatings A. PVC plastisol type			2730	Coated fabrics except rubberized
		2. Carpet backing A. PVC plastisol type			231	Floor coverings
		3. Fiberfill & wadding A. PVAc type			2737	Padding & upholstery filling
		4. Nonwoven fabric binding A. EVA hot melts B. Acrylic type			2736	Nonwoven fabrics & products
		5. Flocking A. Acrylic type			2701	Other finished fibers, yarns & fabrics
		6. Laminating & bonding A. Acrylic type			080	Apparel
		Electrical appliance adhesives -- 1. Dishwashers A. PVC plastisol type			1481	Household electrical & electronic appliances
		2. Refrigerators & freezers A. SBR cement			1484	Refrigeration, air conditioning & heating equipment

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PRODUCT TYPE: INDUSTRIAL ADHESIVES

SOURCE: Skeist Laboratories, Inc., Adhesives & Sealants II, 1972

SOURCE	FUNCTION	APPLICATION	USE AS DESCRIBED USING EPA DESCRIPTORS			
			USE AS NORMALLY DESCRIBED IN THE INDUSTRY			
			Code	Function	Code	Application Name
579.5022 Y Skeist SRI Staff		Automobile adhesives --				
		1. Body assembly				
		A. PVC plastisol				
		B. SBR cement				
		2. Safety glass				
		A. Polyvinyl butyral film				
		Bookbinding adhesives --				
		1. Edition books				
		A. PVAc type				
		2. Stationery				
		A. PVAc type				
		Furniture adhesives --				
		1. Dowel gluing				
		A. PVAc type				
		2. Edge gluing				
		A. PVAc type				
		3. Chair & table top assembly				
		A. PVAc type				
		4. Plastic laminating				
		A. PVAc type				
		5. Wood & vinyl veneering				
		A. PVAc type				
		6. Felt saturation				
		A. PVAc type				
		Footwear adhesives				
		1. Shoe assembly				
		A. Leather shoes				
		1) PVC type				
		2) PVAc type				
580.1883 K						

283 Motor vehicles & equipment

2620 Laminated glass

283 Bookbinding & related operations

1913 Envelopes & stationery products

100 Household furniture

100

100

100

100

2732 Felt goods

1212 Leather footwear

PRODUCT TYPE: INDUSTRIAL ADHESIVES

SOURCE: Skeist Laboratories, Inc., Adhesives & Sealants II, 1972

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Application		
			Code	Name	Name
580.1883 K		B. Simulated leather shoes 1) PVC type	074	Rubber & plastic footwear	
		Other leather and simulated leather goods adhesives --			
		1. Leather luggage A. PVC type	1214	Leather luggage	
		2. Leather handbags & purses A. PVC type	1213	Leather gloves (includes handbags, wallets, key & glass cases, change purses and other leather cases)	
		3. Simulated leather luggage A. PVC type	070	Miscellaneous fabricated plastics products	
		4. Simulated leather handbags & purses A. PVC type	070		
		Plastic products adhesives --			
		1. Toys A. PVC type	168	Toys & sporting goods	
		2. Novelties A. PVC type	162	Costume jewelry & notions	
		3. Swimming pool liners A. PVC type	070		
579.5022 X		Pressure sensitive tape adhesives --			
		1. Industrial A. PVC type	19115	Pressure sensitive tapes	

PRODUCT TYPE: INDUSTRIAL ADHESIVES

SOURCE: Skeist Laboratories, Inc., Adhesives & Sealants II, 1972

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Code	Function	Application
579.5022 X		2. Electrical A. PVC type			
		3. Surgical A. PVC type			
		Cigarette tipping adhesives -- 1. PVAc type			
Skeist					
					0709 Unsupported plastic film, sheet, rod & tube
					112 Medical & dental instruments & supplies
					--

PRODUCT TYPE:	INDUSTRIAL ADHESIVES
SOURCES:	DeBell & Richardson, Inc. The Decline & Fall of Solvent-Based Adhesives, 1974; Skeist Laboratories, Inc., Adhesives & Sealants II, 1972

SOURCES: DeBell & Richardson, Inc., The Decline & Fall of Solvent-Based Adhesives, 1974; Skeist Laboratories, Inc., Adhesives & Sealants II, 1972 | Adhesives and Sealants | Adhesives and Sealants

USE AS NORMALLY DESCRIBED IN THE INDUSTRY			USE AS DESCRIBED USING EPA DESCRIPTIONS					
SOURCE	FUNCTION	APPLICATION	Function		Application			
			Code	Name	Code	Name		
Skeist SRI Staff	Solvent	Construction adhesives	384	Solvent	03231	Plastering, drywall, acoustical & insulation work		
		1. Gypsum wallboard						
		A. Neoprene cement						
		B. SBR cement						
		C. Natural rubber cement						
		2. Panels & partitions					103	Partitions & fixtures
		A. Neoprene cement						
		3. Mobile homes						
		A. Neoprene cement					135	Prefabricated wood buildings
		B. PVAc adhesives						
		4. Recreational vehicles					282	Miscellaneous transportation equipment
		A. Neoprene cement						
		5. Metal doors					061	Fabricated structural metal products
		6. Glass fiber insulation						
		A. Neoprene cement					03231	Carpeting & flooring
7. Glued floors & other wood framing								
A. Neoprene cement	0320	Carpeting & flooring						
B. SBR cement								
C. Polyurethane type								
8. Prefabricated buildings	135	Prefabricated metal buildings						
A. SBR cement								
9. Insulating materials	01211	Prefabricated metal buildings						
A. SBR cement								
B. Nitrile adhesives								

*When EPA application is listed more than once on page only code is repeated.

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Code	Function	Code
Skeist SRI Staff		10. Acoustical ceiling panels A. SBR cement	03231	Plastering, drywall, acoustical & in- sulation work	
		11. Ceramic floor & wall tile A. SBR cement B. Reclaim rubber adhesives	03232	Terrazzo, tile, marble & mosaic work	
DeBell		12. Anti-skid coatings & vinyl stair treads A. Nitrile adhesives	03201	Floor laying, scra- ping, & finishing	
		13. Roofing A. Nitrile adhesives	0327	Roofing & sheet metal work	
DeBell Skeist		14. Plastic pipe A. Acrylonitrile-butadiene-styrene copolymer type	0326	Plumbing, heating & air conditioning work	
		Automotive adhesives	283	Motor vehicles & equipment	
		1. Vinyl roofs A. Neoprene cement B. Nitrile adhesives	283		
		2. Vinyl & fabric door components A. SBR cement	283		
		3. Vinyl weather stripping A. Nitrile adhesives	283		
		4. Brake lining to shoes A. Nitrile adhesives	283		
		5. Clutch linings A. Nitrile adhesives	283		
		6. Sound insulating A. Nitrile adhesives B. SBR cement	283		
		7. Windshields & windows A. Nitrile adhesives	283		

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Function		Application Name
			Code	Name	
DeBell Skeist		8. Fuel tank sealing A. Nitrile adhesives	283		Motor vehicles & equipment
		9. Oil filter side seams A. Nitrile adhesives	283		
		10. Floor & trunk carpeting A. SBR cement	283		
		11. Headliners A. SBR cement	283		
		12. Firewall insulation A. SBR cement	283		
		13. Exterior trim A. SBR cement	283		
		14. Assembly A. SBR cement B. Nitrile adhesives C. Reclaim rubber cement D. Polyurethane type E. PVC plastisol type	283		
		15. Aftermarket/repairing A. SBR cement B. Nitrile adhesives	2880		Transportation equipment service & repair facilities
		Footwear adhesives 1. Sole attaching A. Neoprene cement B. Polyurethane type	1212		Leather footwear
		2. Injection molded shoes A. Polyurethane	074		Rubber & plastic footwear

PRODUCT TYPE: Industrial Adhesives

SOURCE	FUNCTION	USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
		APPLICATION	Function	Code	Name	Application	
						Code	Name
DeBell Skeist		3. Heel covering A. Neoprene cement		1212	Leather footwear		
		4. Sock-lining & heel pad A. Natural rubber cement		1212			
		5. Doubling & combining A. Natural rubber cement		1212			
		6. Counter A. Natural rubber cement		1212			
		7. Box toes A. Natural rubber cement		1212			
		8. Canvas A. Natural rubber cement		074	Rubber & plastic footwear		
		9. Miscellaneous A. Nitrile adhesives		1212			
		10. Repairing A. Neoprene cement		1213			
		Textile adhesives					
		1. Flocking A. Neoprene cement		2701	Other finished fibers, yarn and fabrics		
		2. Nonwovens A. Nitrile adhesives		2736	Nonwoven fabrics & products		
		Furniture adhesives					
		1. Assembly A. Neoprene cements B. Urea-formaldehyde resin type		{ 100 1032	Household furniture Wood partition & fixtures		
		2. Vinyl film lamination A. Polyester type B. Polyurethane type		1032			
		3. Plastic/wood lamination A. Neoprene cements		1032			

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS		
SOURCE	FUNCTION	APPLICATION	Function Code	Application Name
DeBell Skelst		4. Wood/vinyl veneering A. Urea-formaldehyde resin type	1032	Wood partition & fixtures
		5. Edge-gluing A. Urea-formaldehyde type	1032	
		Electrical goods adhesives 1. Air conditioners A. Neoprene cement B. Epoxy type	1484	Refrigeration, air conditioning & heating equipment
		2. Refrigerators & freezers A. SBR cement B. Epoxy type C. Asphalt type	1484	
		3. Printed circuits A. Nitrile adhesives B. Polyester type	1436	Semiconductors & related solid state devices
		4. Radio & TV components A. Nitrile adhesives	1400	Radio & television communication equipment
		5. Food disposers A. Epoxy types	1481	Household electrical & electronic appliances
		6. Small appliances A. Epoxy type	1481	
		7. Battery sealants A. Epoxy type	1464 1465	Primary batteries Storage batteries

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Code	Function	Code
DeBell Skelst		Abrasive product adhesives			
	1. Bonded abrasives				
	A. SBR cement				
	B. Natural rubber cement				
	C. Nitrile adhesives				
	D. Phenolic resin type				
	2. Coated abrasives				
	A. Phenolic resin type				
	Friction materials adhesives				
	1. Natural rubber cement				
	2. Nitrile adhesives				
	Pressure sensitive tape				
	1. Paper				
	2. Polyethylene				
	3. Reinforced & impregnated				
	4. Felt				
	5. Cork				
	6. Foil				
	7. Laminated foil				
	8. Vinyl				
	9. Cellophane				
	10. Polyester				
	11. Cloth				
	12. Surgical tape				
	13. Labels				
	14. Decals				
	15. Wall & shelf covering				
			2460	Abrasive products	
			28	Transportation equipment & facilities	
			19115	Pressure sensitive tape	
			0709	Unsupported plastic film, sheet, rod & tube	
			19115	Felt goods	
			130	Cork	
			0651	Metal foil & leaf	
			0651		
			0709	Regenerated cellulosic products, except rayon	
			0708		
			273	Miscellaneous textile products	
			113	Medical & dental instruments & supplies	
			19115		
			19115		
			1916	Wall paper	

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS		
SOURCE	FUNCTION	APPLICATION	Code	Function Name
DeBell Skeist		Aircraft adhesives	280	Aircraft & parts
		1. Frame bonding		
		A. Nitrile adhesives		
		2. Walkways & rugs	280	
		A. Nitrile adhesives		
		3. Helicopter rotor blades	280	
		A. Nitrile adhesives		
		4. Brake bonding	280	
		A. Nitrile adhesives		
		5. Assembly	280	
		A. Nitrile/phenolic structural film		
		B. Epoxy/nitrile structural film		
		Foundry binders		
		1. Shell core & mold		
		A. Phenolic resin type	222	Iron steel foundry products
			224	Nonferrous foundry products
		2. Hot box		
		A. Phenolic resin type		
		3. Conventional		
		A. Phenol-formaldehyde type		
		Packaging adhesives		
		1. Case sealing		
		A. EVA adhesives	193	Paperboard boxes & containers
		2. Carton sealing		
		A. EVA adhesives	193	

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS				
SOURCE	FUNCTION	APPLICATION	Function		Application	
			Code	Name	Code	Name
DeBell Skeist		3. Composite cans A. PVAc type	193	Paperboard boxes & containers		
		4. Paper tubes A. PVAc type	1914	Pressed & molded pulp goods		
		5. Bottle labeling A. PVAc type	09	Food & kindred products		
			05	Drugs & other pharmaceuticals		
			250	Cosmetics & toilet preparations		
		6. Can labeling A. PVAc type	09			
		7. Envelopes A. PVAc type	1913	Envelopes & stationery products		
		8. Paper cups & tubs A. PVAc type	1914			
		9. Folding cartons A. PVAc type	193			
		10. Specialty bags A. PVAc type	{ 1910 0651 193 }	Bags except textile bags		
				Metal foil & leaf		
		11. Gummed tapes & labels A. PVAc type B. Asphalt type	19112	Gummed products		
		12. Capliners A. PVAc type	1912	Die cut paper & board products		

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Function		Application
			Code	Name	
DeBell Skeist		13. Glassine A. PVAc type	19114	Oiled, waxed, & laminated wax paper	
		14. Aluminum foil A. PVAc type	0651	Metal foil & leaf	
		15. Film to film lamination A. Nitrile adhesives B. Polyurethane type	19113	Laminated or coated paper rolls & sheets	
		16. Paper to film lamination A. Butyl rubber type	19113		
		Wood adhesives			
		1. Lumber laminating A. Resorcinol-phenol-formaldehyde	132	Millwork, plywood & structural members	
		Bookbinding adhesives 1. Edition books A. PVAc type	230	Bookbinding & re- lated operations	
		2. Notebooks A. PVAc type	1913	Envelopes & sta- tionery products	
		3. Tablets & pads A. PVAc type	1913		
		4. Business forms A. PVAc type	1913		
DeBell		Miscellaneous adhesives			
		1. Insecticide spray tanks A. Nitrile adhesives	062	Metal cans & shipping containers	
		2. Paper coating A. Nitrile adhesives	1911	Coated & glazed paper products	

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTIONS				
SOURCE	FUNCTION	APPLICATION	Function		Application	
			Code	Name	Code	Name
DeBell		3. Ironing board covers A. Nitrile adhesives			273	Miscellaneous textile products
		4. Film/foil lamination A. Nitrile adhesives			0651	Metal foil & leaf

PRODUCT TYPE: INDUSTRIAL ADHESIVES
SOURCE: Skeist Laboratories, Inc. Adhesives & Sealants II, 1972

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS *		
SOURCE	FUNCTION	APPLICATION	Code	Application Name
Skeist SRI Staff	Tackifier	Packaging adhesives	395	Tackifier
		1. Envelopes		
		A. PVAc		
		2. Paper tubes		
		A. PVAc		
		B. PV alcohol		
		3. Composite cans		
		A. PVAc		
		B. EVA hot melt		
		4. Bottle labeling		
		A. PVAc	1913	Envelopes & stationery products
		B. EVA hot melt		
		5. Can labeling		
		A. PVAc		
		6. Case sealing		
		A. Polyethylene/polypropylene hot melt		
		B. EVA hot melt		
		C. PVAc		
		7. Carton sealing		
		A. Polyethylene/polypropylene hot melt		
		B. EVA hot melt	1914	Pressed & molded pulp goods
		C. PVAc		
		8. Folding carton		
		A. Polyethylene/polypropylene hot melt		
		B. EVA hot melt		
		C. PVAc		
		D. SBR latex		
		9. Paperboard containers & boxes		
		10. Drugs & other pharmaceuticals		
		Cosmetics & toilet preparations		
		Food & kindred products	193	

*When EPA application is listed more than once on a page, only code is repeated.

SOURCE: Skelst Laboratories, Inc. Adhesives & Sealants II, 1972

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SOURCE: Skelet Laboratories, Inc. Adhesives & Sealants II, 1972

SOURCE: Skelet Laboratories, Inc. Adhesives & Sealants II, 1972

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SOURCE: Skeist Laboratories, Inc., Adhesives & Sealants II, 1972

SOURCE: Skeist Laboratories, Inc., Adhesives & Sealants II, 1972

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PRODUCT TYPE: INDUSTRIAL ADHESIVES

SOURCE: Skeist Laboratories, Inc., Adhesives & Sealants II, 1972

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Code	Function Name	Application Name
Skeist SRI Staff	Tackifier	2. Dishwasher A. Neoprene cement			1481 Household electrical & electronic appliances
		3. Food disposers A. Epoxy			1481
		4. Small appliances A. Epoxy			1481
		5. Battery sealants A. Epoxy			1464 Primary batteries 1465 Storage batteries
		Automotive adhesives 1. Original equipment A. Nitrile cement			283 Motor vehicles & equipment
		B. Neoprene cement			
		2. Aftermarket A. Polyester type			2880 Transportation equip- ment services & repair facilities
		Pressure-sensitive adhesives 1. Foil A. Natural rubber			19115 Pressure-sensitive tape
		2. Double-faced A. Natural rubber			
		3. Felt, cork, other substrates 4. Roll label 5. Sheet stock			

PRODUCT TYPE: INDUSTRIAL ADHESIVES

SOURCE: Skeist Laboratories, Inc., Adhesives & Sealants II, 1972

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Code	Function	Application
Skeist SRI Staff	Tackifier	6. Floor tiles A. SBR Cement	163		Hard surface, floor, wall
		7. Paper	19115		Pressure-sensitive tape
		8. Cellophane	0708		Regenerated cellulosic products, except rayon
		9. Vinyl	0709		Unsupported plastic film, sheet, rod & tube
		10. Polyester	0709		
		11. Polyethylene	0709		
		12. Cloth	273		Miscellaneous textile products
		13. Reinforced & impregnated	19115		

SOURCES: Skeist Laboratories, Inc.; Adhesives & Sealants II, 1972; Adhesives Red Book, 1978; Palmerton Publishing Co., N.Y.

SOURCES: Skeist Laboratories, Inc.; Adhesives & Sealants II, 1972; Adhesives Red Book, 1978; Palmerton Publishing Co., N.Y.

*When EPA application is listed more than once on a page, only code is repeated.

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Code	Function	Application
Red Book '78 Skeist SRI Staff	Thickener	11. Bottle labeling A. PVAc	09 05 250		Food & kindred products Drugs & other pharmaceuticals Cosmetics & toilet preparations
		12. Can labeling A. PVAc			
		13. Folding containers A. PVAc			
		14. Gummed tapes & labels A. PVAc	09		Paperboard containers & products
		15. Capliner A. PVAc	193		Gummed products
		16. Glassine A. PVAc	1912		Die cut paper & board products
		17. Aluminum foil A. PVAc	1914		Oiled, waxed, & wax laminated paper
		18. Paper cups & tubs A. PVAc	0651		Metal foil & leaf
		19. Cigarette tipping A. PVAc B. Casein	1914		Pressed & molded pulp goods
		20. Case sealing A. PVAc	16		Miscellaneous - cigarette production
		21. Carton sealing A. PVAc	193		

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Code	Function	Application
Red Book '78 Skeist SRI Staff	Thickener	22. Paper/film laminating A. PVAc	19113	Laminated or coated paper rolls & sheets	19113
		23. Film/film laminating A. PVAc	19113		
		Construction adhesives 1. Panels & partitions A. PVAc	103		
		2. Vinyl film lamination A. PVAc	2602 1032		
		3. Glued floors A. SBR/SBS cement	03201		
		4. Carpet installation A. Neoprene latex	16		
		5. Gypsum wallboard A. Natural rubber latex B. Casein C. PVAc	03231		
		6. Ceramic tile A. Reclaim rubber cement	03232		
		Textile adhesives 1. Fiberfill & wadding A. PVC	2737		
		2. Coatings A. PVC latex B. PVC plastisol C. PVAc D. Neoprene latex E. Acrylic	2730		

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS	
SOURCE	FUNCTION	APPLICATION	Code Function Name Code Application Name
Red Book '78 Skelist SRI Staff		3. Nonwoven	2736 Nonwoven fabrics & products
		4. Flocking A. Acrylic	2701 Other finished fibers, yarns & fabrics
		Bookbinding adhesives	230 Bookbinding & related operations
		1. Edition books A. PVAC	
		2. Stationery A. PVAC	1913 Envelopes & stationery products
		Foundry binders	
		1. Conventional types A. Oleoresinous	{ 222 Iron & steel foundry products { 224 Nonferrous foundry products
		Electrical adhesives	
		1. Air conditioners A. Neoprene cement	1484 Refrigeration, air conditioning & heating equipment
		2. Dishwashers A. Neoprene cement	1481 Household electrical & electronic appliances
		3. Clotheswashers A. Nitrile/phenolic type	1482 Laundry equipment
		Pressure-sensitive adhesives	
		1. Foil A. Natural rubber	0651 Metal foil & leaf
		2. Double faced A. Natural rubber	19115 Pressure sensitive tape
		3. Floor tile A. SBR cement	163 Hard surface floor, wall & counter coverings

PRODUCT TYPE: Industrial Adhesives

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS		
SOURCE	FUNCTION	APPLICATION	Code	Function Name
Red Book '78 Skeist SRI Staff		4. Polyester	0709	Unsupported plastic film, sheet, rod, & tube
		5. Polyethylene	0709	
		6. Cloth	273	Miscellaneous textile products
		7. Vinyl	0709	
		8. Reinforced & impregnated	19115	Pressure sensitive tape
		9. Cellophane	0708	Regenerated cellulose products, except rayon
		10. Paper	19115	
		11. Felt & cork	{ 130 Cork 19115 2732 Felt goods	
		12. Roll labels	19115	
		13. Sheet stock labels	19115	

SOURCES:

Chalmers, L., Household and Industrial Chemical
Specialties, Chemical Publishing Co., Inc.
New York, 1978

Fuchs, R.J., et al., "Agglomerated Automatic Dishwasher Detergents", Chemical Times & Trends, October 1977, pp. 37-42

Chemical Economics Handbook, SRI International,
Menlo Park, California

Summer, C.A., "Agglomeration of Dishwasher Detergents",
Soap, Cosmetics, & Chemical Specialties, July 1975,
pp. 29-50

USE AS NORMALLY DESCRIBED IN THE INDUSTRY

USE AS DESCRIBED USING EPA DESCRIPTORS

SOURCE	FUNCTION	APPLICATION		Function		Application	
				Code	Name	Code	Name
CEH, P. 583.8001F	Antiredeposition Agents			3936	Soil Suspending Agents		
		Laundry Detergents Heavy Duty Powders				25105	Soaps, bars and flakes and detergent powders
		Liquids Built Unbuilt		092	Antistatic Agents	2510	Detergents, soaps & disinfectants
CEH, P. 583.800D	Antistatic Agents			105	Bleaches	2510	
CEH, P. 583.8001F	Bleaching Agents	Laundry Detergents Heavy Duty Powders				25105	
		Presoaks				25104	Scouring cleansers and presoaks
SRI Staff							

*When EPA application is listed more than once on a page, only code is repeated.

*When EPA application is listed more than once on a page, only code is repeated.

PRODUCT TYPE: Household Detergents

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Code	Function	Code
CEH, P. 583.8001H	Buffers		328	pH Control Agents	
Chalmers, P. 35		Laundry Detergents Light Duty Powders			25105
Summer		Dishwashing Detergents Machine			25101 Machine and hand dishwashing compounds
CEH, P. 583.8001H		Light Duty Liquids			25101
CEH, P. 583.8001D	Builders		183	Detergent Builders	
		Laundry Detergents Heavy Duty Powders			25105
		Liquids Built			2510
Chalmers, P. 35		Light Duty Powders			25105
Chalmers, P. 48		Dishwashing Detergents Machine			25101
CEH, P. 583.8001G	Colorants		1410	Dyes	
		Laundry Detergents Heavy Duty Powders			25105
		Liquids Built Unbuilt			2510 2510

PRODUCT TYPE: Household Detergents

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTIONS			
SOURCE	FUNCTION	APPLICATION	Code	Function Name	Code Application Name
Fuchs		Dishwashing Detergents Machine	25101		
CEH, P. 583.8001H		Light Duty Liquids	25101		
CEH, P. 583.8001G	Corrosion Inhibitors	144 Corrosion Inhibitors			
		Laundry Detergents Heavy Duty Powders	25105		
		Liquids Built	2510		
SRI Staff		Dishwashing Detergents Machine	25101		
CEH, P. 583.8001D	Enzymes	215 Enzymes			
		Laundry Detergents Heavy Duty Powders	25105		
SRI Staff		Presoaks	25104		
CEH, P. 583.8001D	Fabric Softeners	379 Softeners			
		Laundry Detergents Heavy Duty Powders	25105		
CEH, P. 583.8001G	Fillers and Diluents	229 Fillers			
		Laundry Detergents Heavy Duty Powders	25105		

PRODUCT TYPE: Household Detergents

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Code	Function	Application
Summer		Liquids Built Unbuilt			2510 2510
		Dishwashing Detergents Machine			25101
		Laundry Detergents Heavy Duty Powders	{ 246 3861	Foam Inhibitors Foam Stabilizers	
Chalmers, P. 48	Foam Regulators	Liquids Built Unbuilt			25105 2510 2510
		Dishwashing Detergents Machine			25101
		Light Duty Liquids			25101
CEH, P. 583.8001H	Opacifying Agents	Dishwashing Detergents Light Duty Liquids	313	Opacifiers	25101
SRI Staff	Optical Brighteners & Bluing Agents	Laundry Detergents Heavy Duty Powders			25105
		Liquids Built Unbuilt			2510 2510

PRODUCT TYPE: Household Detergents

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS		
SOURCE	FUNCTION	APPLICATION	Code	Application Name
SRI Staff Chalmers, p. 35		Presoaks	25104	
CEH, p. 583.8001G	Perfumes	Light Duty Powders	25105	
		Laundry Detergents Heavy Duty Powders	3100	Fragrances
		Liquids Built Unbuilt	25105	
Fuchs		Dishwashing Detergents Machine	2510 2510	
CEH, p. 583.8001H		Light Duty Liquids	25101	
CEH, p. 583.8001G	Solubilizers	Laundry Detergents Heavy Duty Powders	3820	Hydrotropic Agents
		Liquids Built Unbuilt	25105	
CEH, p. 583.8000H		Dishwashing Detergents Light Duty Liquids	2510 2510	
			25101	

PRODUCT TYPE: Household Detergents

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS		
SOURCE	FUNCTION	APPLICATION	Code	Function Name
CEH, p. 583.8000G	Surfactants	Laundry Detergents Heavy Duty Powders	3930	Detergents
		Liquids Built Unbuilt	25105	
		Presoaks	2510	
SRI Staff		Light Duty Powders	2510	
Chalmers, p. 35			25104	
			25105	
Chalmers, p. 48		Dishwashing Detergents Machine	25101	
CEH, p. 583.8000H		Light Duty Liquids	25101	

PRODUCT TYPE: Rubber-Processing Chemicals

SOURCES:

EPST= Canterino, P.J., 1967, "Ethylene Polymers". In: RT= Horton, M., ed., 1973, Rubber Technology, Encyclopedia of Polymer Science and Technology, Second Edition, New York, Van Nostrand Reinhold Company
Volume 6, New York, John Wiley & Sons, Inc.

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS*			
SOURCE	FUNCTION	APPLICATION	Code	Function	Code
RT, pp. 193-194	Blowing Agent	Styrene-butadiene rubber A. Sponge and related 1. Rug underlay B. Footwear 1. Shoe soles	109	Blowing agent	
RT, p. 242		Ethylene/Propylene rubber A. Sponge B. Automotive 1. Auto weatherstripping 2. Trunk lid gaskets		Rubber floor & wall covering	0715
				Rubber heels & soles	0716
				Sponge & foam rubber goods	0718
				Mechanical rubber goods	0710
RT, p. 297		Polyisoprene rubber A. Sponge (oil-extended polyisoprene only)			0718
RT, p. 335		Neoprene rubber A. Sponge B. Automotive 1. Door gaskets			0718
EPST, 6, p. 449		Chlorosulfonated polyethylene rubber A. Footwear 1. Shoe heels & soles			0710 283
RT, pp. 400-401		Silicone rubber A. Sponge			0716
RT, p. 433		Fluorocarbon rubber A. Sponge			0718
					0718

*When EPA application is listed more than once on a page, only code is repeated.

PRODUCT TYPE: Rubber Processing Chemicals

SOURCES:

RT= Morton, M. (ed.), Rubber Technology, Second Edition, Van Nostrand Reinhold Company, New York, 1953
 EPST = Encyclopedia of Polymer Science and Technology, John Wiley & Sons, Inc., New York, Volume 2 (1965), Volume 4 (1966), Volume 6 (1967), Volume 7 (1967), Volume 11 (1969), Volume 12 (1970)

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS*			
SOURCE	FUNCTION	APPLICATION	Code	Function	Code
RT, p. 21 EPST 2, p. 737	Vulcanizing Agent	Styrene-butadiene rubber	413	Vulcanizing agents	076
		1. Tires and tire-related products A. Truck tires B. Passenger tires C. Off-road tires D. Tread 2. Mechanical goods 3. Hard rubber 4. Wire and cable coatings 5. Floorings 6. Footwear and shoe products 7. Adhesives 8. Waterproofed goods 9. Medical A. Drug sundries 10. Toys and athletic goods 11. Sponge 12. Foamed products 13. Manufacture of impact resistant polystyrene		Tires and inner tubes	
RT, p. 218				Mechanical rubber goods	0710
				Miscellaneous fabricated wire products	0655
				Rubber floor & wall coverings	0715
				Rubber & plastic footwear	074
				Adhesives	F009
				Rubber coated fabrics	0713
				Rubber druggist and medical sundries	0714
				Toys & sporting goods	168
				Sponge & foam rubber goods	0718
				Thermoplastic resins & plastics	0718 2131

*When EPA application is listed more than once on a page, only code is repeated.

PRODUCT TYPE: Rubber Processing Chemicals

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS		
SOURCE	FUNCTION	APPLICATION	Code	Function Name Application Code Name
EPST 2, p. 737 RT, pp. 216-218 EPST 2, p. 737		Polybutadiene rubber		
		1. Tires and tire-related products		
		A. Truck and bus tires		
		B. Passenger tires		
EPST 2, p. 737		2. Mechanical goods		
		A. Motor mounts		
		B. Belting compounds		
		3. Footwear and shoe products		
EPST 6, pp. 383-4		A. Heels and shoe soles		
		4. Toys and athletic goods		
		A. High rebound toy balls		
		B. Golf balls		
RT, p. 242		5. Manufacture of impact resistant polystyrene		
		Ethylene/propylene rubber		
		1. Tires and tire-related products		
		A. Sidewalls		
RT, p. 242		B. Coverstrips		
		2. Automotive		
		A. Weatherstripping		
		B. Window seals		
RT, p. 242		C. Caulking		
		D. Radiator hoses		
		E. Engine mountings		
		F. Truck lid gaskets		
RT, p. 242		3. Appliances		
		4. Carpet underlay		

PRODUCT TYPE: Rubber Processing Chemicals

SOURCE	FUNCTION	USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS	
		APPLICATION	Code	Function	Application
RT, p. 242 EPST 2, p. 291		5. Belting			075 Rubber and plastic hose and belting
		6. Wire and cable coating			0655 Miscellaneous fabricated wire products
		7. Footwear			074 Rubber and plastic footwear
		8. Waterproofed goods			0718 Sponge & foam rubber products
RT, p. 242 EPST 2, p. 291		A. Weather-resistant sponge			0713 Rubber coated fabrics
		B. Water-proof coated fabrics			0718
		9. Sponge			
		Butyl and chlorobutyl rubber			
		1. Tires and tire-related products			076 Tires & inner tubes
		A. Inner tubes			
		B. Tire-curing bladders and bags			
		C. Tractor tires			
		D. Automotive tires			
		2. Automotive			
		A. Car-heater and radiator hose			075 Motor vehicles and equipment
		B. Distributor nipples			283
		C. Spring boosters			
		D. Starter buttons			
		E. Steering-rod stabilizers			
		F. Axle and body bumpers			
		G. Pedal pads			
		H. Auto topping			
		I. Brake bellows			
		J. Spark-plug nipples			
		K. Bushings			
		L. Truck-cab mounts			

SOURCE	FUNCTION	APPLICATION	USE AS DESCRIBED USING EPA DESCRIPTORS			
			Code	Function	Application Name	
RT, p. 242 EPST 2, p. 791	3.	Tapes	0710	Mechanical rubber goods		
		A. Wrapping and slicing tapes				
		B. Pressure-sensitive tapes				
		4. Seals				
		A. Domestic appliance seals				
		B. Window channels and seals				
		C. Home-canning seals				
		D. Diaphragms				
		E. Gearshift seals				
		F. Bottle-cap seals				
G. Gaskets						
1. Sterilizer gaskets						
RT, p. 276	5.	Textiles	0713	Rubber coated fabrics		
		A. Linsmen's blanket				
		B. Protective clothing				
		6. Footwear				
		A. Chemical-resistant boots				
		7. Mechanical goods				
		A. Conveyor belts				
		B. Pads				
		1. Rail pads				
		2. Bridge bearing pads				
EPST 2, p. 791	8.	Hose	075			
		A. Garden hose				
		B. Steam hose				
		9. Medical				
		A. Hospital sheeting				
		B. Heating pads				
		C. Pharmaceutical stoppers				
		0713				Rubber druggist and medical sundries
		0714				
		0714				

PRODUCT TYPE: Rubber Processing Chemicals

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS		
SOURCE	FUNCTION	APPLICATION	Function	
			Code	Name
EPST 2, p. 791 RT, p. 297		10. Toys and athletic goods A. Football bladders	1682	Sporting and athletic goods
		Polyisoprene rubber	076	Tires & inner tubes
		1. Tires and tire-related products A. Truck tires		
		B. Aircraft tires		
		C. Off-road tires		
		D. Passenger tires		
		2. Mechanical goods A. Gaskets	0710	Mechanical & rubber goods
		B. Flat belts	075	Rubber & plastic hose and belting
		C. O-rings	0710	
		D. Sheet rubber	0710	
		E. Rubber bands	0717	Rubber stationers' sundries
		F. Cut thread	0717	
		G. Battery separators	0710	
		H. Rubber-covered rolls	0710	
		3. Automotive A. Bushings	283	Motor vehicles and equipment
		B. Motor mounts		
		4. Medical A. Hospital sheeting	0713	Rubber coated fabrics
		B. Pharmaceutical sundries	0714	Rubber druggist and medical sundries
		5. Food-related A. Baby bottle nipples	0714	
		B. Milk tubes		
		6. Sponge	0718	Sponge and foam rubber goods

PRODUCT TYPE: Rubber Processing Chemicals

SOURCE	FUNCTION	USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS		
		APPLICATION		Code	Function Name	Application Name
RT, p. 297 EPST, 7, p. 843 EPST 2, p. 737		7. Footwear and shoe products				
		A. Soles and heels				
		8. Toys and sporting goods				
		A. Golf balls				
		Nitrile rubber				
		1. Mechanical goods				
		A. Gaskets				
		B. Oil seals				
		C. Oil hose				
		D. Belting				
RT, p. 306 EPST 2, p. 737 RT, p. 335		E. Oil well parts				
		F. Fuel cell liners				
		G. Fuel hose				
		H. Tank liners				
		Neoprene rubber				
		1. Automotive				
		A. Window gaskets				
		B. Motor mounts				
		C. Wire jackets				
		D. Shock absorber covers				
		E. Blown sponge for door gaskets				
		F. Molded seals				
		G. Belts				
		1. V-belts				
		2. Transmission				
		2. Aviation				
		A. Mountings				
		B. Wire and cable gaskets				
		C. Deirers				
		D. Seals				

PRODUCT TYPE: Rubber Processing Chemicals

SOURCE	FUNCTION	APPLICATION	USE AS NORMALLY DESCRIBED IN THE INDUSTRY			USE AS DESCRIBED USING EPA DESCRIPTORS		
			Code	Function	Name	Code	Application	Name
EPST 2, p. 728 RT, p. 335	3. Railroad	A. Track mounting				286	Railroad car & equipment	
		B. Car body mounting				286		
		C. Air brake hose				{ 286 075	Rubber and plastic hose and belting	
	4. Construction	D. Flexible car connectors				286		
		A. Building seals				0710	Mechanical rubber goods	
		B. Concrete-highway joist seals				0310	Bridges, tunnels and elevated highways	
	5. Food-related products	C. Bridge pads and mounts				0710		
		D. Soil-pipe gaskets				0710		
		E. High rise window wall seals				1801	Barn and roof paints	
	6. Medical	F. Roof coatings				{ 0710 1493	Food processing equip- ment	
A. Creamery hose								
B. Jar rings								
EPST 2, p. 728	7. Textiles	C. Can closures						
		A. Closures for drug ampules				0714	Rubber druggist and medical sundries	
		A. Gloves				0711	Rubber apparel	
	8. Mechanical goods	A. Belts				075		
		1. Conveyor						
		2. Escalator hand rails						
	9. Hose	B. Hose				075		
		1. Fire						
		2. Dredging						
	10. Industrial	3. Garden						
4. Industrial								
5. Gasoline curb pump								
11. Oil	6. Oil delivery							
	7. Oil suction							
	8. Air							

SOURCE	FUNCTION	USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS	
		APPLICATION		Function	Application
EPST 2, p. 728 RT, pp. 346-347		C. Molded goods		Code	Name
		9. Wire and cable jackets		0710	Mechanical rubber goods
		Chlorosulfonated polyethylene rubber		0655	Miscellaneous fabri- cated wire products
		1. Tires and tire-related products			
		A. White sidewalls		076	Tires and inner tubes
		2. Automotive			
		A. Spark plug boots		{ 0655 283 }	Motor vehicles and equipment
		B. Primary and ignition wire coatings			
		C. Power steering hose liners and jackets		{ 283 075 }	Rubber and plastic hose and belting
		3. Construction		0710	Mechanical rubber goods
EPST 6, pp. 449 RT, pp. 316 -317		A. Curtain wall gaskets			
		4. Textiles			
		A. Tarpaulins		0713	Rubber coated fabrics
		B. Rain wear		0711	Rubber apparel
		C. Boat covers		0713	
		D. Radomes		0710	
		E. Inflatable structures		0713	
		F. Insulating blankets		075	
		G. Fabric conveyor belts			
		5. Wire and cable sheetlinings		0655	
	A. Control cable				
	B. Mine trailing cable				
	C. Service drop wire				
	D. Motor lead wire				
	E. Telephone handset cords				
	F. Appliance cords				
	G. Weatherproof wire				

PRODUCT TYPE: Rubber Processing Chemicals

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS		
SOURCE	FUNCTION	APPLICATION	Function	
			Code	Name
EPST 6, p. 449		6. Food and food-related products A. Food industry conveyor belts		
RT, pp. 346-347		7. Electrical accessories A. Cable connectors B. Sockets C. Line hose D. Insulating hoods	1493 075	Food process equipment Rubber and plastic hose and belting
EPST 6, p. 449		8. Floor tile	0710 075 0710	Mechanical rubber goods
RT, pp. 346-348 EPST 6, p. 449 RT, pp. 346-347		9. Hose A. Garden B. High pressure steam C. Discharge D. Industrial water hose covers E. Line hose	0715	Rubber floor and wall coverings
EPST 4, pp. 732 6766		Polysulfide rubber 1. Dental impression material 2. Electronic embedding material	112 143	Medical and dental instrument supplies Electronic components and accessories
RT, pp. 364-366		3. Rollers for paints and inks 4. Hose liners (solvent-resistant)	0710 075	
ESPT 11, p. 441		5. Gaskets 6. Gas meter diaphragms 7. Acid-resistant rubber-sulfur cements	0710 0710 F009	

PRODUCT TYPE: Rubber Processing Chemicals

SOURCE	FUNCTION	APPLICATION	USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
			Code	Function	Name	Code	Application	
								Name
RT, p. 369		Silicone rubber 1. Automotive A. Spark plug boots B. Ignition cable jacket C. Seals and sealants 1. Transmission 2. Engine 3. Windshield D. Hose E. Maintenance applications F. Shock absorber fluid 2. Aerospace A. Seals 1. Airframe opening (doors, windows, etc.) 2. Aerodynamic balance and control surface seals 3. Lubricating system 4. Hydraulic system 5. Gaskets & O-rings 6. Firewall bulkhead B. Hot air ducts C. Dust shields D. Limit switch boots E. Jet engine starter hose F. Airframe and spacecraft body sealants G. Insulation 1. Aircraft & missile wire 2. Missile external and base heating H. AN connector inserts				283	Motor vehicles and equipment	
						{	0655	Miscellaneous fabricated wire products
						{	283	Mechanical rubber goods
						{	0710	
						{	283	
						{	075	Rubber & plastic hose and belting
						{	283	
						{	283	
						{	0710	
						{	280	Aircraft and parts
						{	075	
				0710				
				280	Guided missiles and space vehicles & parts			
				281				
				280				

PRODUCT TYPE: Rubber Processing Chemicals

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS		
SOURCE	FUNCTION	APPLICATION	Code	Function Name Application Code Name
RT, p. 369		3. Appliances A. Seals, gaskets, and insulation 1. Oven doors 2. Washers-dryers 3. Steam irons 4. Frying pans 5. Coffee makers 6. Air conditioners	1481	Household electrical and electronic appliances
				0710 Mechanical rubber goods
EPST 12, p. 552		4. Sponge	1484	Refrigeration, air conditioning and heating equipment
			0768	Sponge and foam rubber goods
RT, p. 370		5. Electronic A. Capacitor bushings B. Rubber-coated glass sleeving C. Rubber tubing D. Television corona shields E. Television receiver high-voltage circuits F. Potting, impregnation and encapsulation	1431	Electronic capacitors
			143	Electronic components and accessories
EPST 12, p. 545			143	Cathode ray television picture tubes
			1430	Semiconductors and related solid state devices
RT, p. 370		6. Wire and cable jackets A. Apparatus lead wire B. Appliance & fixture wire C. Defroster harness wire D. Electronic hook-up wire E. Nuclear power cable F. Naval vessel wire	143	Miscellaneous fabricated wire products
			0655	Miscellaneous fabricated wire products

PRODUCT TYPE: Rubber Processing Chemicals

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS		
SOURCE	FUNCTION	APPLICATION	Code	Function Name
EPST 12, p. 546		7. Medical	112	Medical and dental instruments and supplies
		A. Tubing B. Surgical implants 1. Artificial heart valves 2. Artificial arteries 3. Encapsulation of electronic heart-beat stimulators C. Prosthetic devices D. Dental impressions E. Research applications F. Pharmaceutical stoppers G. Bouncing putty for rehabilitative therapy		
EPST 12, p. 550 RT, p. 370		8. Construction	0710	Mechanical rubber goods
		A. Sealants 1. Suspended window walls 2. Expansion joints 3. Glazing 4. Truck & house trailers 5. Silos and grain cribs 6. Radomes B. Weatherproof coatings 1. Roof 2. Wall 3. Deck		
EPST 12, pp. 544-552		9. Food and food-related products		
		A. Conveyor belts		
			1801	Barn and roof paints
			1802	Exterior house paints
			1802	
			075	Rubber and plastic hose and belting
			1493	Food processing equipment

PRODUCT TYPE: Rubber Processing Chemicals

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS				
SOURCE	FUNCTION	APPLICATION	Function		Application	
			Code	Name	Code	Name
		10. Molds A. Jewelry B. Furniture			0710	Mechanical rubber goods
		11. Toys A. Bouncing putty			1681	Games, toys, and children's vehicles
		12. Household repairs			04001	Dwelling cleaning and maintenance
		13. Gas masks A. Decorating leather & vinyl B. Sculpture C. Paint			0710	
		Fluorocarbon rubber 1. Seals A. O-rings B. Gaskets C. Extrusions D. Cross-sectional configurations			1690	Art supplies
					0710	
		2. Hose A. Rubber-lined B. Rubber-covered C. Fabric-reinforced			075	Rubber and plastic hose and belting
		3. Rolls A. Paper processing B. Film processing C. Fabric processing			0710	
		4. Textiles A. Clothing			0711	Rubber apparel

PRODUCT TYPE: Rubber Processing Chemicals

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS		
SOURCE	FUNCTION	APPLICATION	Code	Function Name
RT, p. 433		5. Food and food-related products A. Food processing B. Carbonated beverage handling	1493	Food process machinery
		6. Medical Pharmaceutical handling	149	Special industry machinery
		7. Valve & pump linings	0710	Mechanical rubber goods
		8. Protective overlay for flammable substances	0710	
		9. Sponge	0718	Sponge and foam rubber products

PRODUCT TYPE: Trade Sales Paints

SOURCES: Chemical Economics Handbook, SRI International, U.S. Department of Commerce, Bureau of the Census, 1967 Census of Manufactures, Numerical List of Menlo Park, California, pp. 592.5500 A-E. Manufactured Products, U.S. Government Printing Office, 1968.

SOURCE	FUNCTION	APPLICATION	USE AS NORMALLY DESCRIBED IN THE INDUSTRY				USE AS DESCRIBED USING EPA DESCRIPTORS *			
			Code	Function	Name	Code	Code	Application	Name	
CEH SRI Staff 1967 Census	Anti-foaming agents	1. Exterior paints A. All purpose water-based paints B. Masonry water-based paints C. Other exterior water-based paints 2. Interior paints A. Flat water-based paints B. Semigloss water-based paints C. All purpose water-based paints D. Other interior water-based paints	{246 {160	Foam inhibitors Defoamers						
CEH SRI Staff 1967 Census	Anti-skinning agents	1. Exterior solvent-based paints A. Oil and alkyd vehicle house paints B. Sash, trim & trellis enamels C. Porch & deck enamels D. Undercoaters & primers E. Barn & roof paints F. Marine paints & enamels G. Metallic paints H. Traffic paints I. Automotive & machinery -- refinishing paints J. Automotive & machinery -- primers & undercoaters								

* When EPA application is listed more than once on a page, only code is repeated.

PRODUCT TYPE: Sales Trade Paints

USE AS NORMALLY DESCRIBED IN THE INDUSTRY			USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Function		Application	
			Code	Name	Code	Name
CEH SRI Staff 1967 Census	Driers	K. Oleoresinous varnish			1807	Varnishes (exterior)
		L. Stains (including shingle & shake)			1805	Stains (exterior)
		M. Other exterior oil paints			1802	Exterior house paints
		2. Interior solvent-based paints				
		A. Flat wall paints			1830	Interior oil base wall & trim paints
		B. Gloss & quick dry enamels			1830	
		C. Semigloss enamels			1830	
		D. Primers & undercoaters			1830	
		E. Other interior oil paints			1830	
		F. Varnishes, except shellac			1832	Varnishes (interior)
		G. Shellac varnish			1832	
		H. Interior oil & alkyd stains			1831	Stains (interior)
		I. Aerosol paints			183	Interior oil base paint products
		1. Exterior solvent-based paints				
		A. Oil and alkyd vehicle house paints			1802	
		B. Sash, trim & trellis enamels			1802	
		C. Porch & deck enamels			1802	
		D. Primers & undercoaters			1802	
		E. Barn & roof paints			1801	Barn & roof paints
		F. Marine paints & enamels			1803	Marine paints & enamels, except industrial
		G. Metallic paints			1804	Metallic paints
		H. Traffic paints			1806	Traffic paints
		I. Automotive & machinery -- refinishing paints			1800	Automotive & machinery refinishing paints & enamels
		J. Automotive & machinery -- primers and undercoaters			1800	

PRODUCT TYPE: Trade Sales Paints

SOURCE	FUNCTION	USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS	
		APPLICATION	Code	Function	Code Name
CEH SRI Staff	Pigments: Colored & black	K. Oleoresinous varnish			1807 Varnishes (exterior)
		L. Stains (including shingle & shake)			1805 Stains (exterior)
		M. Other exterior oil paints			1802 Exterior house paints
		2. Exterior water-based paint			
		A. Acrylic/alkyd all purpose paint			1810 All purpose water emulsion paints & tinting bases
		3. Interior solvent-based paint			
		A. Flat wall paints			1830 Interior oil base wall & trim paints
		B. Gloss & quick dry enamels			1830
		C. Semigloss enamels			1830
		D. Primers & undercoaters			1830
		E. Other interior oil paints			1830
		F. Varnishes, except shellac			1832 Varnishes (interior)
		G. Interior oil & alkyd stains			1831 Stains (interior)
		H. Aerosol paints			183 Interior oil base paint products
		1. All trade sales paints except varnishes and other clear finishes		1411 Pigments	
					1800 Automotive & machinery refinishing paints & enamels
					1801 Barn & roof paints
					1802
					1803 Marine paints & enamels, except industrial
					1804 Metallic paints
					1805
					1806 Traffic paints
					181 Exterior water base paint products
					1830
					1831
					184 Interior water base paint products
					185 Lacquers

PRODUCT TYPE: Trade Sales Paints

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Code	Function	Application
SRI Staff	Pigments: Corrosion Inhibitors	1. Metallic paints	144	Corrosion Inhibitors	1804 Metallic paints
		2. Automotive & machinery -- refinishing paints			1800 Automotive & machinery refinish paints & enamels
		3. Automotive and machinery -- lacquers			1850 Automotive original & refinish lacquers
		4. Automotive & machinery -- primers and undercoaters			1800
CEH SRI Staff 1967 Census	Pigments: Extenders (non-opaque)	1. Exterior paints	233	Extenders	
		A. Oil and alkyd house paints			1802 Exterior house paints
		B. Porch & deck enamels			1802
		C. Primers & undercoaters			1802
		D. Barn & roof paints			1801 Barn and roof paints
		E. Traffic paints			1806 Traffic paints
		F. Automotive & machinery -- refinishing paints			1800
		G. Automotive & machinery -- primers & undercoaters			1800
		H. All purpose water-based paints			1810 All purpose water emulsion paints & tinting bases
		I. Masonry water-based paints			1811 Masonry water emulsion paints & tinting bases
		J. Other exterior water-based paints			1810
		2. Interior paints			
		A. Flat wall paints			1830 Interior oil base wall and trim paints
		B. Gloss & quick dry enamels			1830
		C. Semigloss enamels			1830
		D. Primers & undercoaters			1830
		E. Flat water-based paints			1840 Interior water emulsion wall & trim paints
		F. Semigloss water-based paints			1840
		G. All purpose water-based paints			1840
		H. Other water-based paints			1840

PRODUCT TYPE: Trade Sales Paints

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS				
SOURCE	FUNCTION	APPLICATION	Function		Application	
			Code	Name	Code	Name
CEH	Pigments: White (opaque)	1. Exterior paints	1411	Pigments		
		A. Oil & alkyd vehicle house paints			1802	Exterior house paints
		B. Sash, trim & trellis enamels			1802	
		C. Porch & deck enamels			1802	
		D. Primers & undercoaters			1801	Barn & roof paints
		E. Barn & roof paints			1803	Marine paints & enamels, except industrial
		F. Marine paints & enamels				
		G. Metallic paints			1804	Metallic paints
		H. Traffic paints			1806	Traffic paints
		I. Automotive & machinery -- refinishing paints			1800	Automotive & machinery refinish paints & enamels
		J. Automotive and machinery -- primers & undercoaters			1800	
		K. Other exterior oil paints			1802	
		L. All purpose water-based paints			1810	All purpose water emulsion paints & tinting bases
		M. Masonry water-based paints			1811	Masonry water emulsion paints & tinting bases
		N. Other exterior water-based paints			1810	
		2. Interior paints				
		A. Flat wall paints			1830	Interior oil base wall & trim paints
		B. Gloss & quick dry enamels			1830	
		C. Semigloss enamels			1830	
		D. Primers & undercoaters			1830	
		E. Other interior oil paints			1830	
		F. Aerosol paints			183	Interior oil base paint products
		G. Flat water-based paints			1840	Interior water emul- sion wall & trim paints
		H. Semigloss water-based paints			1840	
I. All purpose water-based paints			1840			
J. Other water-based paints			1840			

PRODUCT TYPE: Trade Sales Paints

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS			
SOURCE	FUNCTION	APPLICATION	Code	Function	Application
CEH SRI Staff 1967 Census	Preservatives & mildewcides				
		1. Exterior oil & alkyd vehicle house paints	{ 2570 339 }	Mildew preventives Preservatives	1802 Exterior house paints
		2. Exterior all purpose water-based paints A. Acrylic emulsion type B. Acrylic-alkyd light tint type C. PVAc emulsion type			1810 All purpose water emulsion paints & tinting bases
		3. Exterior masonry water-based paints A. Acrylic white types B. Vinyl acetate copolymer			1811 Masonry water emulsion paints & tinting bases
		4. Other exterior water-based paints A. Acrylic emulsion type primer B. PVAc type primer			1810
		5. Interior flat water-based paints A. Acrylic flat wall paint B. Vinyl acetate copolymer flat white paint C. Vinyl-acrylic flat paint			1840 Interior water emulsion wall & trim paints
		6. Interior semigloss water-based paints A. Acrylic latex gloss white enamel B. Acrylic emulsion semigloss paint C. PVAc white semigloss enamel			1840
		7. Interior all purpose water emulsion paints			1840
		8. Interior water-based paints including pastes & semi pastes A. Acrylic white type B. Vinyl acetate copolymer white type			1840

PRODUCT TYPE: Trade Sales Paints

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS	
SOURCE	FUNCTION	APPLICATION	Application
			Function Name Code Name
SRI Staff 1967 Census	Propellants	Aerosol paints	014 Aerosol propellants 183 Interior oil base paint products
CEH	Resin binders (film-forming agents)	All trade sales paints	{104 Binders {140 Coating agents 180 Exterior oil base paint products 181 Exterior water-base paint products 183 Interior water-base paint products 184 Interior water-base paint products 185 Lacquers
CEH SRI Staff 1967 Census	Solvents	All trade sales paints (including water-based) 1. Exterior paints A. Oil and alkyd vehicle house paints B. Sash, trim & trellis enamels C. Porch & deck enamels D. Primers & undercoaters E. Barn & roof paints F. Marine paints & enamels G. Metallic paints H. Traffic paints I. Automotive & machinery -- refinishing paints J. Automotive & machinery -- primers & undercoaters K. Oleoresinous varnish	384 Solvents 1802 Exterior house paints 1802 1802 1802 1801 1803 1804 1806 1800 1800 1807 1807 Marine paints & enamels, except industrial Metallic paints Traffic paints Automotive & machinery refinish paints & enamels Varnishes (exterior)

PRODUCT TYPE: Trade Sales Paints

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS				
SOURCE	FUNCTION	APPLICATION	Function		Application	
			Code	Name	Code	Name
		L. Stains (including shingle & shake)			1805	Stains (exterior)
		M. Other exterior oil paints			1802	Exterior house paints
		N. All purpose water-based paints			1810	All purpose water emulsion paints & tinting bases
		O. Masonry water-based paints			1811	Masonry water emulsion paints & tinting bases
		P. Other exterior water-based paints			1810	
		2. Interior paints				
		A. Flat wall paints			1830	Interior oil base wall & trim paints
		B. Gloss & quick dry enamels			1830	
		C. Semigloss enamels			1830	
		D. Primers & undercoaters			1830	
		E. Other interior oil paints			1830	
		F. Varnishes, except shellac			1832	Varnishes (interior)
		G. Shellac varnish			1832	
		H. Interior oil & alkyd stains			1831	Stains (interior)
		I. Aerosol paints			183	Interior oil base paint products
		J. Flat water-based paints			1840	Interior water emulsion wall & trim paints
		L. All purpose water-based paints			1840	
		M. Other water-based paints			1840	
		3. Lacquers				
		A. Automotive & machinery -- lacquers			1850	Automotive original & refinish lacquers
		B. Other trade sales lacquers			1851	Fabricated metal lacquers
					1852	Paper and paperboard lacquers
					1853	Wood lacquers

PRODUCT TYPE: Trade Sales Paints

USE AS NORMALLY DESCRIBED IN THE INDUSTRY		USE AS DESCRIBED USING EPA DESCRIPTORS		
SOURCE	FUNCTION	APPLICATION	Code	Function Name Code Application Name
CEH Staff SRI Staff 1967 Census	Surfactants & dispersing agents		{ 493 { 3931	Surfactants Dispersants
		1. Exterior paints		
		A. All purpose water-based paints	1810	All purpose water emulsion paints & tinting bases
		B. Masonry water-based paints	1811	Masonry water emulsion paints & tinting bases
CEH Staff SRI Staff 1967 Census	Thickeners	C. Other exterior water-based paints	1810	
		2. Interior water-based paints		
		A. Flat water-based paints		
		B. Semigloss water-based paints		
		C. All purpose water-based paints		
		D. Other interior water-based paints		
		1. Exterior paints		
		A. All purpose water-based paints	1810	
		B. Masonry water-based paints	1811	
		C. Other exterior water-based paints	1810	
CEH Staff SRI Staff 1967 Census	Thickeners	2. Interior paints		
		A. Flat water-based paints		
		B. Semigloss water-based paints		
		C. All purpose water-based paints		
CEH Staff SRI Staff 1967 Census	Thickeners	D. Other interior water-based paints		

APPENDIX D

INSTRUCTIONS FOR REPORTING CHEMICAL USES

INSTRUCTIONS FOR REPORTING CHEMICAL USES

1.0 INTRODUCTION

This section provides specific instructions for using this manual in reporting chemical use information.

2.0 INSTRUCTIONS FOR REPORTING CHEMICAL USES

2.1 DEFINITION OF CHEMICAL USE

For purposes of reporting within this classification system, the concept of "use" has been divided into two components, i.e., function and application. In this classification system, "function" and "application" are defined as follows:

- Function: what a chemical is used as--an action or process which the chemical itself performs. Function terms denote classes of substances which perform a common action or process, e.g., "adhesives", "slime preventives".
- Application: what a chemical is used in--a chemical process, product or activity in which the chemical is employed, e.g., "petroleum distillation" (chemical process), "leather gloves" (product), "cleaning and maintenance" (activity).

For example, a chemical may function as a soil release agent for application to yarns and fabrics. Do not report as a use a subsequent production or formulation operation which results in a product that does not contain the chemical being reported. For example, if acrylonitrile functions as a polymerization monomer, and the resulting polyacrylonitrile is used in the formulation of coatings for yarns and fabrics, report the function of acrylonitrile as a monomer and the application as finished

yarns and fabrics. For each chemical use reported, you will need to provide one function and one application, as described below.

Please note that each unique combination of a function and an application constitutes a distinct use, different from other uses which may have as a component the same function or application, but not both.

2.2 INSTRUCTIONS FOR REPORTING FUNCTION

In order to report the function component of a chemical use, you will need List I, which contains function terms in a hierarchical classification, and the alphabetical index to List I.

2.2.1 Step 1: Using the Index to Locate the Appropriate Function

First, turn to the index to List I and look for a term (or terms) that, to your knowledge, most nearly corresponds to the function of the chemical in the use you are reporting. In searching the index, bear in mind that entries are listed in direct, rather than in inverted form. For example, the term "Cyclic Chemicals" is listed as such, and not as "Chemicals, Cyclic".

Entries in the index to List I are of two types: valid terms, which are to be used for reporting functions, and cross-references to valid terms. All valid terms in the index are followed by a three or four character code which identifies the location of the term in the hierarchical structure of List I. Cross-references are of two types: "see" and "see also", e.g.,

Cleansing agents
See: Cleaners 136

Coloring agents

See also: Stains 387

The "see" cross-reference refers a user from a synonym to the valid term which is preferred for reporting purposes. The "see also" cross-reference refers a user from one valid term to another valid term denoting a related function. The purpose of the "see also" cross-reference is to alert the user to related terms which may describe the function more appropriately.

2.2.2 Step 2: Locating the Selected Function Term in the Hierarchical List

Having selected a valid function term, look up its code* in List I. Keep in mind that List I is arranged hierarchically, so that, for example, 1490, 1491, and 1492 follow 149. In List I, a definition is supplied for each function term. In addition, some terms have scope notes indicating the limits of a term's usage within the classification. Read the definition and scope note for the term you have chosen, as well as for other terms in the hierarchy (if any). (Occasionally you will be referred from a "see" cross-reference in the index to a valid term with a definition, but no hierarchical relationships.) In this way, you can judge whether the term you selected initially is the most specific and most appropriate function for the chemical use being reported. Turn back to the index and begin the selection process again, if you feel you have not located the proper function term.

*While most codes contain only numbers, a few contain letters as well. The sequence is zero to 9, followed by A to Z.

You may locate valid functions that are near-synonyms but that are employed specifically by different industries. A typical example of this situation is the term class "surfactants", which includes the subcategories, "wetting agents" and "detergents". A given surfactant substance may be variously described as a surfactant, wetting agent or detergent, depending on the industry in which it is used. In such instances, report the term which is consistent with terminology in the industry for which use is being reported.

2.2.3 Step 3: Reporting Function

When you have selected from List I the most appropriate valid function term, locate the line shown below:

Term Code	Term Name
List I. FUNCTION [][][][]	_____

Write the code of the term you have chosen in the designated boxes, and then write the term name on the line following the coding boxes. Always write the code beginning in the leftmost box, even if the code for the term you have selected has only three characters. A completed function entry is shown below.

Term Code	Term Name
List I. FUNCTION [3][8][6][]	<u>STABILIZERS</u>

If you could not find an appropriate term in List I which fits the function concept you have in mind, even though you have searched the index, you may supply an appropriate term in the

following manner. List I contains the term class "315 OTHER". Use this term class to report a new function, as follows:

Term Code	Term Name
List I. FUNCTION [3][1][5][]	<u>OTHER - (NEW TERM)</u>

When you add a new term as described, you must, in addition, provide a definition of the new term being reported. Before adding new terms, however, examine the existing terms carefully for applicability.

2.3 INSTRUCTIONS FOR REPORTING APPLICATION

In order to report the application component of a chemical use, you need List II, which contains application terms in a hierarchical classification, and the alphabetical index to List II.

2.3.1 Step 1: Using the Index to Locate the Appropriate Application

First, turn to the index to List II and look for the most appropriate application term (or terms) that, to your knowledge, combines with the function you have just selected, as described above, to denote the use you are reporting. The index to List II is similar to the index to List I in format and contains valid application terms and codes, synonyms with "see" cross-references, and "see also" cross-references.

If you cannot find an appropriate term in the List II index, return to the List I index and look for the application there. (See the special situation rule explained in Section 2.5 below.)

If you are reporting on Agricultural Chemicals or Chemical Intermediates, please see Section 2.6 for specific instructions on how to proceed.

2.3.2 Step 2: Locating the Selected Application Term in the Hierarchical List

Having selected a valid application term in the index, look up its code* in List II. Keep in mind that List II is arranged hierarchically in three levels of specificity from most general to most specific, e.g.,

012	CROP PRODUCTION
012Q	CASH GRAIN PRODUCTION
01200	CORN PRODUCTION
01201	RICE PRODUCTION

Read any scope notes, and examine the other terms in the hierarchy. Select the most specific appropriate application term which you are able to locate in List II.

2.3.3 Step 3: Reporting Application

When you have chosen an application term, locate the line shown below:

List II. APPLICATION [][][][][] _____

Write the code of the term you have chosen in the designated boxes, and then write the term name on the line following the coding boxes. Always write the code beginning in the leftmost box, even if the code for the term you have selected has fewer than five characters.

*While most codes contain only numbers, a few contain letters as well. The sequence is zero to 9 followed by A to Z.

A completed application entry is shown below.

List II. APPLICATION [2][0][0]][][] PETROLEUM BLENDING
AND COMPOUNDING

If you could not find an appropriate application term in List II (or in List I, as explained in Section 2.5), you may supply an application term in the following manner.

List II contains the term class "MISCELLANEOUS PRODUCTS AND SERVICES 16". Use this term class to report a new application as follows:

LIST II. APPLICATION [1][6][][][] MISCELLANEOUS -
(NEW TERM)

Before adding new terms, however, examine the existing terms carefully for applicability.

2.4 ADDITIONAL GUIDELINES FOR REPORTING USES

2.4.1 Choosing the Most Specific Term Available

If you are seeking a term which is more specific than the most specific applicable term given in Lists I and II, use the more general term as given. For example, in reporting a chemical used as a binder for grinding wheels, you would look up the term "BINDERS" in the index to List I and would enter this term for function. You might then look for the term "grinding wheels" in the index to List II. However, the closest appropriate term in List II is "ABRASIVE PRODUCTS", and this is the term you should select.

If, on the other hand, you do not know the specific application of a chemical, you may also report a more general application. For example, in the term grouping:

212	NONCELLULOSIC ORGANIC FIBERS
2120	ACRYLIC AND MODACRYLIC FIBERS
2121	POLYAMIDE FIBERS
2122	POLYESTER FIBERS
2133	POLYOLEFIN FIBERS

If you do not know the specific type of fiber in which a chemical is used, you may report "212 NONCELLULOSIC ORGANIC FIBERS."

2.4.2 Repeating a Function With Different Applications

If a single function has more than one application (List II), repeat the same function (List I) as many times as necessary to cover each application reported. Each unique combination of a function and an application constitutes a distinct use, different from other uses which may have as a component the same function or application, but not both. For example, sodium silicate, when functioning as a binder, has applications in both paperboard container manufacture and iron and steel foundry product manufacture. This information would be coded as follows:

Term Code	Term Name
List I. FUNCTION [1][0][4][]	<u>BINDERS</u>
List II. APPLICATION [1][9][3][][]	<u>PAPERBOARD</u>
	<u>CONTAINERS AND BOXES</u>
Term Code	Term Name
List I. FUNCTION [1][0][4][]	<u>BINDERS</u>
List II. APPLICATION [2][2][2][][]	<u>IRON AND STEEL</u>
	<u>FOUNDRY PRODUCTS</u>

2.4.3 Repeating an Application With Different Functions

If the chemical functions in more than one way in the same application, repeat the same application as many times as necessary to cover each function reported. For example, a particular chemical may function as both a solvent and a reaction medium in the same application.

2.4.4 Choosing the Most Appropriate Function/Application Combination(s)

While you are encouraged to report as many unique function/application combinations as necessary to cover all uses of the chemical known to you, please report only those combinations which most closely correspond to the specific conditions of use for the reported chemical. In other words, if you discover two function terms which both come close to the function of the chemical in the use you are reporting, choose the one you believe to be most appropriate. Do not report both.

2.5 SPECIAL SITUATION RULE FOR USING A DOUBLE FUNCTION

In certain cases, a chemical may have as its application not a process, product or activity (which is the way this classification system defines application), but rather another function. For example, the chemical toluene may function as a solvent in the formulation of an adhesive. According to this classification system, both "solvent" and "adhesive" are considered functions. (The adhesive may later be used to laminate materials such as fabrics, plastics and wood, and as such would have a valid application in the context of the system.)

In this case, you would select two terms from List I and use them to report both function and application. Code the List I code and term as usual on the List I coding line. Code the List I code and term being used, in this instance, to describe application, on the List II coding line, placing a letter F in the leftmost box, as follows:

Term Code	Term Name
List I. FUNCTION [3][8][4][]	<u>SOLVENTS</u>
List II. APPLICATION [F][0][0][9][]	<u>ADHESIVES</u>

2.6 SPECIAL REPORTING INSTRUCTIONS FOR AGRICULTURAL CHEMICALS AND CHEMICAL INTERMEDIATES

2.6.1 Agricultural Chemical Reporting

In the List II term class, "AGRICULTURE, FORESTRY AND FISHING", crop-related applications such as fertilization, weed control and soil preparation are not included. (These are described in terms of functions in the classification system, e.g., fertilizers, herbicides, soil conditioners.) Instead, you should report the application of a given chemical to a given crop or crops. For example, a fertilizer (List I) for cotton crops should be associated with the List II term, "COTTON PRODUCTION".

2.6.2 Chemical Intermediate Reporting

In the context of this classification system, a chemical intermediate is defined as a chemical compound that is formed in the sequence of chemical reactions between a starting material and a product. This definition excludes chemical compounds which are mixed with other compounds to make a formulated product

without undergoing a chemical change. For example, nitrobenzene used in the manufacture of aniline would be considered a chemical intermediate. On the other hand, nitrobenzene used as an ingredient of shoe polishes would not be considered an intermediate.

In reporting on a chemical intermediate which is used to make more than one chemical substance of the same type (e.g., cyclic chemicals), report only one use. If the chemical intermediate is used to make more than one type of chemical substance (e.g., acyclic chemicals and reagent and high purity grade chemicals), report as many uses as appropriate.

APPENDIX E

FUNCTION TERMS DEFINED AS
CONTAINING TWO OR MORE FUNCTIONS

<u>Code No.</u>	<u>Function Term</u>	<u>Code No.</u>	<u>Function Term</u>
006	Acidulants	299	Metal treating agents
007	Activators	300	Microbiocides
020	Analytical and product testing agents	307	Nucleating agents
049	Antifogging agents	323	Papermaking agents
108	Bloom inhibitors	324	Papermaking aids
136	Cleaners	330	Pickling agents
145	Coupling agents	334	Plastics compounding agents
151	Curing agents	335	Polymerization additives
180	Desiccants	339	Preservatives
184	Developers	354	Resists
191	Disintegrating agents	356	Rubber compounding agents
197	Drilling mud conditioners	363	Scavengers
200	Dust control agents	365	Scouring agents
209	Eluting agents	379	Softeners
213	Etching agents	380	Soil conditioners
224	Feed supplements	387	Stains
232	Finishing agents (textile technology)	389	Stiffening agents
235	Fixatives	392	Surface finishing agents
241	Flour treating agents	399	Textile conditioners
2452	Melting fluxes	400	Texturizers
247	Food conditioners	401	Thickeners
249	Formulation aids	403	Toners
251	Fuel additives	404	Tonics
255	Functional fluids	414	Water repellents
268	Hormones	417	Well treating agents
287	Latex compounding agents	425	Peptizing agents

APPENDIX F

SIGNIFICANCE OF THE ASSUMPTIONS

The six assumptions used in the preceding assessment of sorting errors are generally biased toward acceptability of the system. The rationale for this generalization follows.

A. Use of Ten Groups

Use of 10 rather than 15 groups biases the analysis toward lower probabilities of an erroneous assignment of priority to a use category, because the broader the point spread in a group, the lower the probability that a one-point error will cause a shift from one group to another.

B. Use of Even-Sized Scoring Groups

This neither obviously favors nor disfavors the acceptability of use categories. If the interval sizes were larger for high-priority groups than for low-priority groups, the probability of erroneous decisions would be reduced. However, broader categories would tend to be less useful, due to the rise in the number of use categories that they would tend to contain. Moreover, although the probability that errors would be made decreases as the groups are enlarged, the probability that an error would be important would rise by an equal amount.

C. Even Distribution of Use Categories

If most of the use categories fell in the vicinity of the cut-off point, the percent of regulatory errors would rise relative to what this assumption would predict. Conversely, were they clustered away from this point, the probability of error would fall. Hence, the assumption neither greatly favors nor disfavors the concept of use as a surrogate for exposure.

D. Restriction of Analysis to One-Point Errors

Multiple errors in the same directions would make the system look worse; hence, this assumption biases the analysis in favor of the concept of use as a surrogate for exposure. Multiple errors in varied directions would tend to offset each other and would have correspondingly less effect. (Although the probability of multiple errors could be developed using a complex computer program, it would be costly to do so.)

E. Independence

If the errors in the estimation of the ten values needed for the scoring procedure were not independent, the errors that occurred would tend to be multiple, and hence, when they occurred, would be more serious. They would not necessarily be more frequent.

F. High Threshold

In the absence of a bias toward overestimation of the score to be assigned to the components of the scoring methodology, only very high scores can be obtained with a low incidence of errors. In contrast, numerous combinations of compensating multiple errors can give scores in the middle of the range of possible values. This problem is greatest for the score of 25, the midpoint in the range of possible scores.